Compressed Air Magazine

Vol. XXXI, No. XI London New York Paris 35 Cents a Copy

NOVEMBER, 1926

CIRCULATION THIS ISSUE
28,436 COPIES

Courtesy, Denver Tourist Bureau

THE SURE-FOOTED BURRO AND THE WATER WAGON ARE PICTURESQUE FEATURES OF MINING LIFE IN THE COLORADO ROCKIES

Norman Dam Development in Canada
S. T. McCavour

Care and Service Operation of Air-Driven Tools
F. A. Jimerson

Where the Government's Printing is Done
R. G. Skerrett

Summer Colony Gets Needful Water Supply
A. M. Hoffmann

(TABLE OF CONTENTS AND ADVERTISERS' INDEX, PAGE 5)

60 Years of Success

That is the background of each Cameron Pump. During all these years it has been the Company's constant endeavor to build better and still better pumps.

Such a program has resulted in unexcelled pumping equipment—and the confidence displayed by customers indicates that Cameron Pumps have always been of the best.

To earn this confidence, Cameron business must have been conducted under an irreproachable sales policy, and the service rendered must have convinced Cameron users that the Company stands behind each unit it sells.

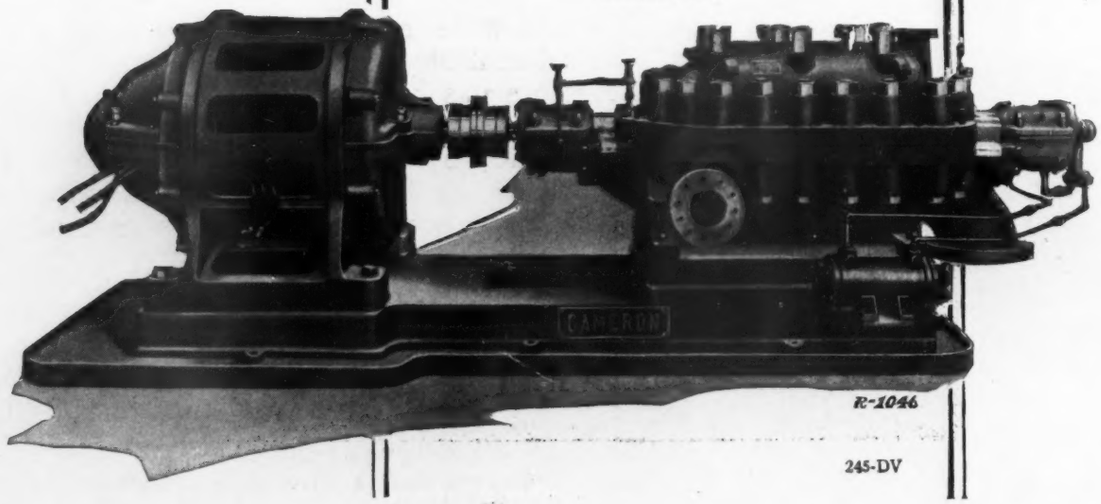
In this period of 60 years, Cameron Engineers have collected a tremendous amount of information on pumps and pumping duties. Let them help you with your problems.

A. S. Cameron Steam Pump Works
11 Broadway New York

Offices in Principal Cities the World Over

Ingersoll-Rand Co., Ltd., Queen Victoria St., London, E. C. 4

Canadian Ingersoll-Rand Co., Ltd., St. James St. Montreal, Que.



R-1046

245-DV

Cameron Pumps

As a matter of reciprocal business courtesy help trace results

CONTENTS OF THIS ISSUE

Vol. XXXI, No. XI, November, 1926

NOTE—For subscription terms see first Editorial page

Articles

Where the Government's Printing is Done. *Robert G. Skerrett*..... 1803

Largest Oil-Electric Tanker Finishes 18,000-Mile Run on Schedule 1809

Pageant Reviews History of Black Hills 1811

Isle of Man Has Modern Fog Horn 1812

Descending Electric Cars Drive Compressor 1812

Summer Colony Gets Needful Water Supply. *A. M. Hoffmann*.... 1813

Norman Dam Development. *A. A. Paoli* and *S. T. McCavour*..... 1817

Making Our Dollar Bills Last Longer 1822

British Quarry Managers Association Stage Interesting Exposition 1823

Windmills to Generate Electricity. 1824

Choice, Care, and Service Operation of Air-Driven Tools. *F. A. Jimerson* 1825

Putting Goldfish to Work in an Ice-Cream Plant 1831

Pneumatic Safety Device for a Punch Press 1831

Air Pressure Operates Damper Regulator 1831

Editorials—New Factor in Foreign Trade Competition—Government Completing Oil-Shale Plant—Inland Waterways Service Shows Profit—Strengthening Our Ties With Canada 1833

Book Reviews 1833

Freight-Train Radio Successful.... 1834

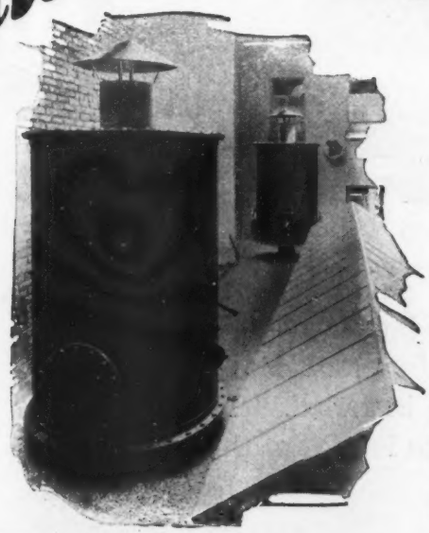
Notes of Industry 1834

Advertisements

American Hoist & Derrick Co..... 25
Emmett F. Annis..... 23
Bucyrus Company 9
Bury Compressor Co..... 22
Cameron, A. S., Steam Pump Works 2
Caterpillar Tractor Co..... 21
Combustion Engr. Corp..... 18
Continental Motors Corp..... 17
Erie Steam Shovel Co..... 25
France Packing Co..... 23
General Electric Co..... 12
Goodrich, B. F. Co. 20
Goodyear Tire & Rubber Co..... 10
Greene Tweed & Co.....Back Cover
Hercules Powder Co..... 16
Ingersoll-Rand Co. 6-7, 27
Jarecki Mfg. Co..... 24
Jewett 22
Ladew Co., Inc., Edw. R..... 24
Manzel Bros. Co..... 24
Maxim Silencer Co..... 5
Midwest Air Filter Co..... 13
New Jersey Meter Co..... 23
Nordberg Mfg. Co..... 25
Reed Air Filter Co..... 4
Staynew Filter Corp..... 26
Stowe, George M., Jr..... 25
Swartwout Company 24
Vacuum Oil Co..... 14
Waukesha Motor Co..... 8
Western Wheeled Scraper Co..... 11
Westinghouse Electric & Mfg. Co.. 3

Silence!

Imagine The Noise Without These Silencers



A small court yard in the heart of New York City. In the rear—a tenement; on the left—a high wall; on the right—a small factory; in front—another tenement;

and below—heavy duty compressors.

Just imagine the noise without these Silencers.

THE MAXIM SILENCER COMPANY

P. O. Drawer 2102, Hartford, Conn.

The intakes to two large air compressors—1,700 and 2,400 foot capacities—lead through the tops of these two Maxim Silencers.

Suction noises and pulsations are made entirely inoffensive.

For oil and gas engines, air compressors, uniflow steam engines, positive pressure blowers, reducing and safety valves and other equipment having noisy intakes or exhausts.

MAXIM SILENCER

For Industrial Purposes

Reg. U.S. Pat. Off.

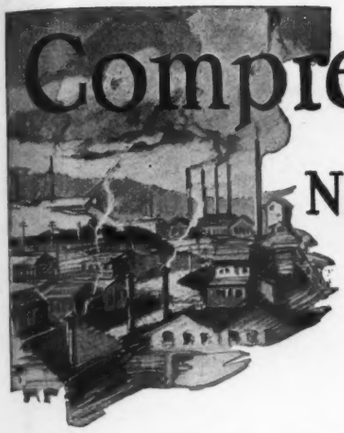
The Riverside Ice Company's plant at Jacksonville, Fla., is one of several new ice plants in Florida in which Ingersoll-Rand Oil-Engine-Driven Ammonia Compressors have been installed. This plant has three 100-h.p. units. The other equipment is that of the Henry Vogt Machine Company.

INGERSOLL-RAND COMPANY · 11 Broadway · New York City

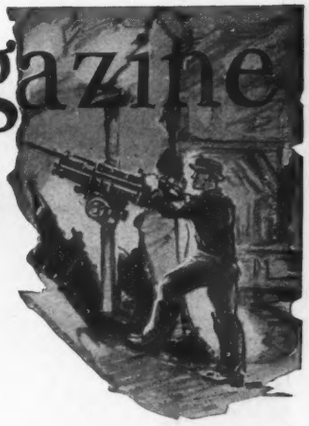
For Canada refer Canadian Ingersoll-Rand Co., Limited, 260 St. James St., Montreal

ATLANTA	BIRMINGHAM	BOSTON	BUFFALO	BUTTE	CHICAGO	CLEVELAND
DALLAS	DETROIT	DENVER	DULUTH	EL PASO	HOUGHTON	JOPLIN
LOS ANGELES	NEW ORLEANS	NEW YORK	PHILADELPHIA	PITTSBURGH	KNOXVILLE	POTTSVILLE
SAN FRANCISCO	SALT LAKE CITY	SCRANTON	SEATTLE	ST. LOUIS	WASHINGTON	

As a matter of reciprocal business courtesy help trace results



Compressed Air Magazine



NEW YORK · LONDON · PARIS

Principal Offices
Bowling Green Building
No. 11 Broadway
New York.

VOL. XXXI, NO. XI

Copyright MCMXXVI
Compressed Air Magazine Co.
NOVEMBER, 1926

Where the Government's Printing is Done

Some Little Known Facts About the Vast and Splendidly Equipped Plant That Does This Important Work

By ROBERT G. SKERRETT

HOW MANY of us are aware that the finest and best-equipped printing and binding plant in the world is located in the City of Washington, and that it serves each and all of us in a way that no other kindred establishment does? We are speaking of the Government Printing Office—an institution that has now been in active service for a period of 65 years, and is steadily gaining in importance.

Millions of our citizenry know in a general way that the Government Printing Office exists, because they are more or less frequent recipients of books, pamphlets, bulletins, and other printed matter produced there; but relatively few of the public at large are familiar with the quantity and the character of the products turned out by this busy plant. In order that those benefited by the work of that bustling office may appreciate its manysided functions, let us first review briefly the reasons for its organization and then contrast the original plant with the one which is today among the show features of the National Capital.

One hundred and thirty-seven years ago, the solons of the first session of our National Legislature recommended that proposals be invited for "printing the laws and other proceedings of Congress." That was the beginning of a problem that grew more vexatious with the passing of each decade of our increasing dignity as a nation. For more than threescore and ten years thereafter, the Congress and the various Federal executive departments had their proceedings and their reports printed under contract with different private concerns; and the results were frequently far from satisfactory—measured by the standards of accuracy, neatness, dispatch, and reasonable cost.

As a climax to much fault-finding and cumulative monetary waste, Congress, on February 19, 1861, appropriated $135,000 to cover the purchase price of a printing plant, then located in the City of Washington and owned and operated by Joseph T. Crowell. Thus was called into being what was first officially designated as the Public Printing Office—later named the Government Printing Office. The Federal authorities took possession of the Crowell property on March 4, 1861. On the same site has since been reared the really splendid establishment which is the subject of this article.

THE Government Printing Office should be of interest to every American citizen not only because of the ways it serves the public but because of the unusual size of the plant and the unique and varied work done by it.

The establishment has been a Government institution for 65 years, and has grown and grown until it is of splendid proportions and distinctive by reason of the modernity and the multiplicity of its facilities.

In the course of a year the plant uses 42,000,000 pounds of paper, 12,000,000 yards of wire, 28,000,000 yards of sewing thread, 114,000 pounds of ink, 60,000 pounds of glue, 200,000 yards of binding cloth, 100,000 square feet of leather, and 22,000,000 square inches of gold and imitation gold leaf and other stamping materials.

The Crowell property, which then housed the largest printing plant in Washington, consisted of a building 4 stories high covering a ground area of 243 feet by 61½ feet. Within it, at the time of purchase, were 26 presses and 4 bindery machines; and the operating force was made up of 350 people. The present modern structure of the Government Printing Office is a handsome 8-story building having a floor space of 17 acres; and the mechanical equipment consists in part of 175 presses and 326 bindery machines. The working force averages the year round substantially 4,000 persons. These contrasting figures, striking as they are, give only an imperfect impression of the changes that have been wrought in the interval—many of the more spectacular of the improvements having been provided in the last five years. These betterments are due in the main to the initiative and the executive skill of Mr. George H. Carter, who became Public Printer on April 5, 1921. In the five and a half years that have intervened, Mr. Carter has accomplished wonders in bringing about economies and in increasing the efficiency of the organization under his charge.

Mr. Carter has steadily improved working conditions, equipment, and output—always with an eye single to effecting savings wherever possible. As he expressed it in his last annual report: "The most accurate measure of the success of a manufacturing establishment is its operating cost. Tested by that gage, The Government Printing Office was more successful during the fiscal year of 1925 than ever before in the 65 years of its operation."

Before describing those phases of the Government Printing Office that should be of particular interest to the readers of Compressed Air Magazine, we shall mention some of the outstanding services performed by the establishment in meeting the diversified demands of Congress and of the several executive departments located in Washington. First, it

Left—Some of the 36 machines that do the folding in the bindery of the Government Printing Office.
Right—In this section of the Government Printing Office 44 skillful bookbinders are required to handle the many and the miscellaneous jobs dealt with continually.

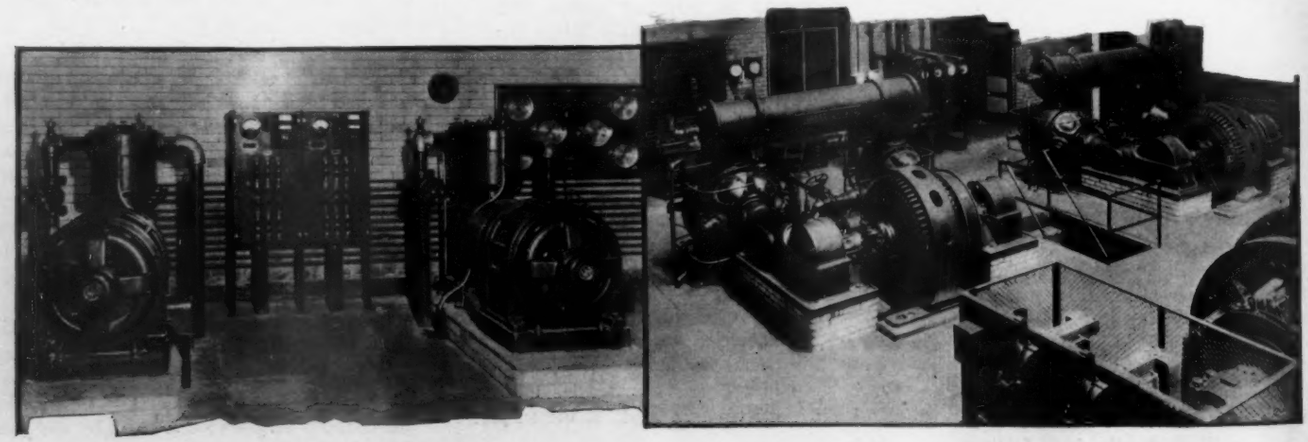
might be well to mention that the work of the Government Printing Office entails a monthly expenditure of substantially $1,000,000, and that this sum must be covered by payments made for the products or the services sold.

It is not generally known that Congress provides the Government Printing Office each year with the required working capital, and that this working capital is based upon an estimate that is the result of a very careful examination of previous demands and the probable demands that may arise during the forthcoming fiscal year. In other words, the work done is sold in virtually the same manner that similar work is marketed by commercial printing offices. The productive activites are composition, platemaking, presswork, and binding; and every item sold must carry, in addition to the charges for labor and material, its proper share of the cost of the overhead of the office. This fact is mentioned because the taxpayer knows that governmental plants are seldom conducted on lines that adhere so closely to those practices that prevail in the best of private industrial organizations.

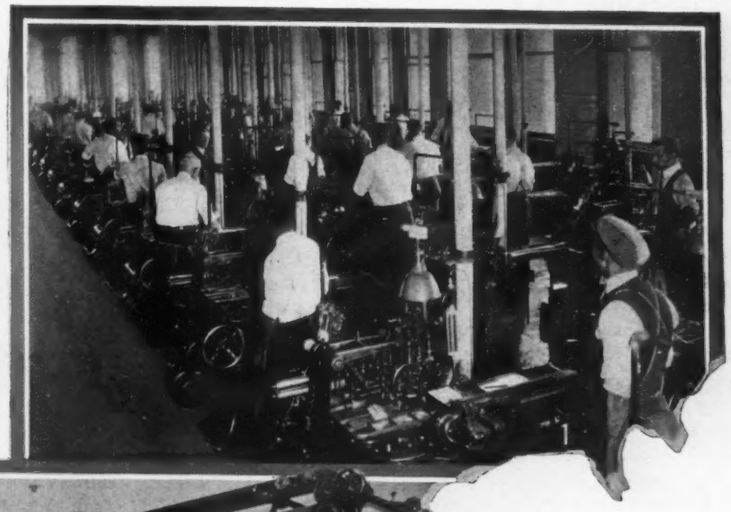
In the way of composition, the office handles each year something like 33,000 job and 45,000 book or pamphlet orders that have a sale value of $3,500,000. In the platemaking division, the value of the output averages $306,000 annually. The presswork division turns out products having an average yearly value of $2,700,000, while the binding division does work that averages every twelvemonth a value of $2,235,000. These sums are all large ones; and yet every penny expended in the several productive divisions is covered, as has been explained, by the charges for the goods or services sold.

In its relations with the National Legislature, the Government Printing Office is called upon to print and to prepare for distribution the *Congressional Record*. On the morning of each legislative day of Congress, printed copies of all proceedings incidental to the previous day's sessions are on the desks of the members of that august body. These include bills, resolutions, reports, hearings, documents, etc., and the *Congressional Record*. Each issue of the *Record* contains all the speeches and all the debates of the day before. Inasmuch as the public is alive to the meaning of the term "legislative eloquence," it is not difficult to grasp something of the task with which the compositors and the printers—not to mention proofreaders—have to contend in getting the *Record* out on time. In the course of a legislative session, the *Record* may consist of anywhere from 8 to 192 or more pages—the average being about 80 pages; and the number of copies printed daily is 33,500. During 1924, the *Record* made 12 volumes, each of more than 1,000 pages; and the cost of that work was $465,836.12. This expenditure becomes much more significant when we recall that the first specific appropriation for public printing, passed by Congress in 1794, provided a sum of $10,000 which was expected to pay for "firewood, stationery, and printing." The halls of Congress were then heated in a somewhat primitive manner; and, besides printing the legislative proceedings, it was necessary to provide paper and envelopes for official correspondence.

In order to print the *Congressional Record* both rapidly and economically, a special and newly equipped section has been called into being in the main building of the Government Printing Office. There, every operation in connection with the publishing and the distributing of the *Record*, except typesetting, proofreading, and platemaking, is carried out. Near the new presses are two gathering ma-



Left—These two motor-driven, Type 20, I-R vertical compressors alternately provide operating air for various purposes in the Government Printing Office during night shifts and on holidays.
Right—The two big Type "PRE-2" compressors that take turns in furnishing compressed air for many services during the hours of maximum activity in the Government Printing Office.



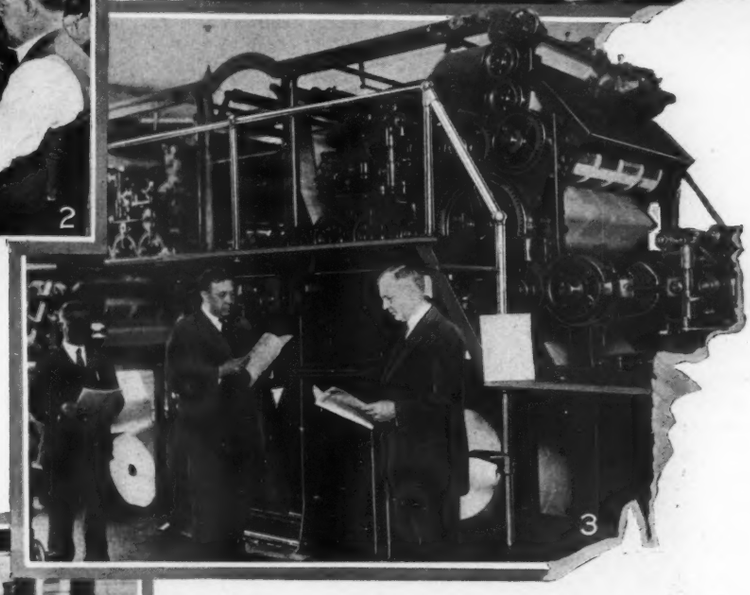


Fig. 1—A few of the big battery of 144 linotype typesetting machines.
Fig. 2—The formidable array of 126 monotype casters that produce finished type from the perforated paper rolls made by the monotype keyboards
Fig. 3—In the main pressroom. Mr. George H. Carter, Public Printer, at right; Deputy Public Printer, Mr. John Greene, at left; and Mr. Bert E. Bair, Superintendent of Presswork, in center
Fig. 4—One of the 120 monotype keyboards which perforate the paper rolls from which type is later cast by the monotype casting machines. Compressed air punches the paper.
Fig. 5—The three new postal-card presses that are capable of printing 7,000,000 cards in the course of an 8-hour day.

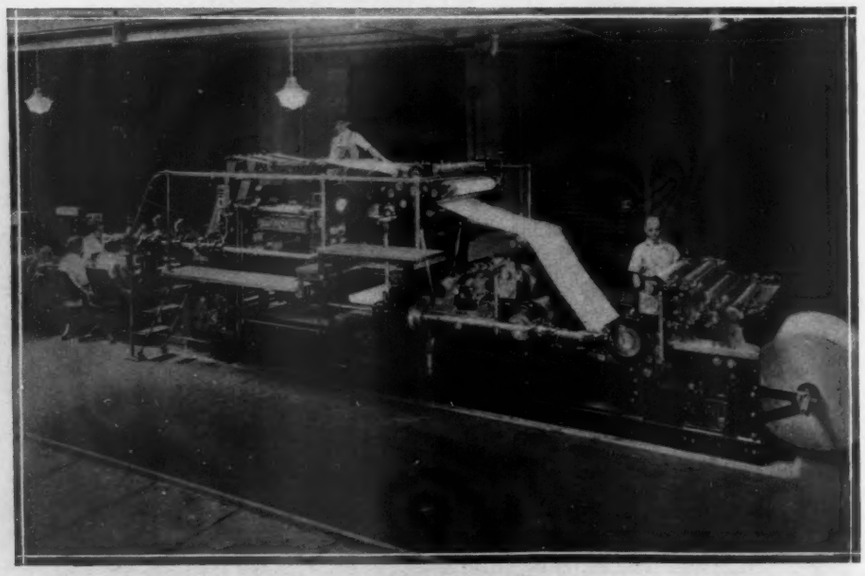
chines for collating and wire-stitching extra "signatures" whenever a day's *Record* is made up of more than 64 pages. At the end of the gathering machine there is a powerful continuous trimmer; and from the trimmer the finished copies go to nearby mailing tables where the copies are wrapped and carried by a moving belt to mailing sacks at one end of each table.

As rapidly as the sacks are filled, they are dumped into a chute and transported by a belt conveyor, through a tunnel, to the neighboring City Post Office a block away, whence they are transferred to the Union Station and promptly placed on outgoing trains—all within five minutes after leaving the Government Printing Office. Perhaps a still better idea of the speed with which the *Congressional Record* is produced can be had if we mention that on one occasion the stereotyped plates for an issue of 140 pages were cast in the amazingly brief time of 128 minutes! When Congress is in session, 350 sacks filled with copies of the *Record* are dispatched nightly and sent by rail far and wide throughout the country. The copies intended for members of the Senate and the House of Representatives are delivered directly to the Capitol.

It is not possible within the space available here to enumerate or to detail all the things done by the Government Printing Office for Congress and for the different departments of the National Government. However, we can mention a few of the outstanding services rendered, and these will suffice to give a suggestive idea of the important and the diversified activities of the organization over which Mr. Carter presides.

Money-order section where are printed, collated, and bound the many millions of money-order forms used by the United States Post Office Department.

The bowling alley on the eighth floor is one of the several attractive recreational features of the Government Printing Office.



One of the three postal-card presses. This machine can produce 6,400 cards a minute.

The Government Printing Office publishes the reports issued annually by the several executive departments, and besides this work the office prints for those departments certain bulletins, pamphlets, and other numerous publications issued from time to time, some of them frequently. The multiplicity of these documents has raised the Government Printing Office to the position of the world's largest publisher, whose publications are of the most varied in character and of practical use to the greatest number of people. The Division of Public Documents of the Government Printing Office distributes in the course of a year 60,000,000 copies of publications of one sort or another; and there are kept on hand at all times an average of 30,000,000 copies of approximately 70,000 different publications.

In the course of six months of one year, the office printed, folded, gathered, stitched, and trimmed 11,000,000 *Farmers' Bulletins* that varied in size from 16 to 100 pages. Of the *Agriculture Yearbook*, 400,000 copies are printed and bound annually; and each edition requires 1,200,000 pounds of paper, 170,000 pounds of binders' boards, 50,000 yards of vellum, and 580 spools of thread.

Besides printing each twelvemonth millions of copies of patent specifications for the United States Patent Office, the Government Printing Office publishes weekly the voluminous *Official Gazette* of the Patent Office—a work that requires every seven days the pro-

duction of more than 1,200 line cuts. Probably the work done by the Government Printing Office for the United States Post Office Department might seem the most spectacular of its activities, although this work represents only a minor part of the tremendous annual output of the establishment.

But few of us are familiar with the vast number of postal cards and of money-order forms sold or used by the Post Office Department in its main and branch offices. During the fiscal year of 1925, the plant printed 1,595,376,890 cards; and during the current year the demand will call for substantially 1,800,000,000 postal cards.

To meet this stimulated demand, the Government Printing Office is equipped with three new presses that are marvels of mechanical perfection and productivity. Each press can turn out 6,400 printed postal cards every minute; and the three presses have a combined output of more than 7,000,000 cards in the course of an 8-hour working day. A 33-inch roll of paper is used for printing the cards; and 80 cards are printed at every revolution of the plate cylinder. After it is printed, each roll is slit into 10 ribbons of postal-card width, which are then chopped mechanically, at lightning speed, into individual cards, automatically counted into packs of 50 each, and delivered on tape conveyors to tables at the ends of the presses. Women envelop each pack with paper bands and place the packs in cartons holding 10 packs apiece. If the postal cards printed in 1925 were placed end to end in a single strip, that ribbon would be long enough to wrap more than five and a half times around the earth at the equator. The 1926 output will probably be long enough to go around the equator in a similar way six and a quarter times!

During the fiscal year of 1925, the Government Printing Office printed substantially 220,500,600 post-office money-order forms—an increase of 16 per cent. over the output of the year before. Money-order forms are produced from rolls of sensitized and watermarked paper by special presses which, by a continuous operation, print both sides of the sheet —two colors on one side; consecutively number each order in several places; print the name and number of the respective office on each order; perforate the purchaser's stub; and collate according to the consecutive numbers. The sheets are then verified, put into packs of individual orders, and bound into books composed of 200 orders each for the convenience of postmasters. The year's output was 1,102,503 such books. According to Mr. Carter: "The annual fluctuation in the quantity of money orders required in the trade of the country has long been considered an accurate barometer of business conditions."

In the course of a year, more than 42,000,000 pounds of paper are consumed in the Government Printing Office; and as much as 15 tons of metal are used daily by the typesetting machines, of which there are 270 in service. This is the largest battery of typesetting machines in any printing plant; and this up-to-date equipment helps to explain how it is possible for the establishment to turn out a tremendous volume of excellent work at a high rate of speed. Excellence, efficiency, and economy are the triple watchwords of the office; and to this end not only are thoroughly modern facilities provided but every operating expense—both little and big—is checked up in order to insure savings wherever practicable. In this effort to reduce operating ex-

Top, left—One end of one of the presses which print the Congressional Record.
Top, right—Southwest section of main pressroom, with a rotary web magazine press in the center.
Bottom—A group of paper-ruling machines. The office prints in the course of a year substantially 3,000,000,000 copies of all kinds of blanks, notices, schedules, cards, etc.

Machine-sewing unit of the Government Printing Office.

Part of the cafeteria where 3,000 appetizing meals are served daily at a notably moderate price.

Monotype-keyboard room in which is installed a total of 120 of these time-saving machines that utilize compressed air.

pense, the use of compressed air has contributed to a marked degree, according to Mr. A. E. Hanson, Superintendent of Construction and Maintenance. This will be understandable if we outline the various ways in which compressed air is utilized throughout this manysided establishment.

In the 120 monotype keyboards, which turn out the paper rolls afterwards placed on the 126 monotype casters, the paper is perforated or punched pneumatically. Compressed air also is fed to the gas burners that melt the type metal for the pots of the two large batteries of monotype and linotype machines. Compressed air is employed to agitate the electrolyte in the electroplating vats. This agitation or aerating insures a uniform and a more rapid deposit of copper than is otherwise feasible. When longer wear is desired, the plates are first coppered and then nickeled —compressed air likewise agitating the nickel-plating electrolyte. Switchboards, electric motors, presses, and machinery in the bindery and elsewhere are frequently blown clean with jets of compressed air.

In the plant there are no fewer than 30 elevators, having runs ranging from one floor to nine floors, most of the doors of which are operated pneumatically. Compressed air is used for this purpose because it has been found to be the most efficient medium available for the service. Compressed air conveys waste paper from the trimming machines through an 8-inch duct to a room where the scrap material is baled. Compressed air is utilized to function a number of hoists installed in different parts of the plant. The humidity of the atmosphere in the testing room—an important department of the establishment—is controlled by compressed air; and compressed air is used effectively in the hospital provided for the personnel within the plant. Compressed air is employed in the plumbing and the machine shops for making repairs; and air-driven drills and riveting hammers are part of the equipment required from time to time in doing construction work of one sort or another. The starting and stopping whistle is blown with compressed air.

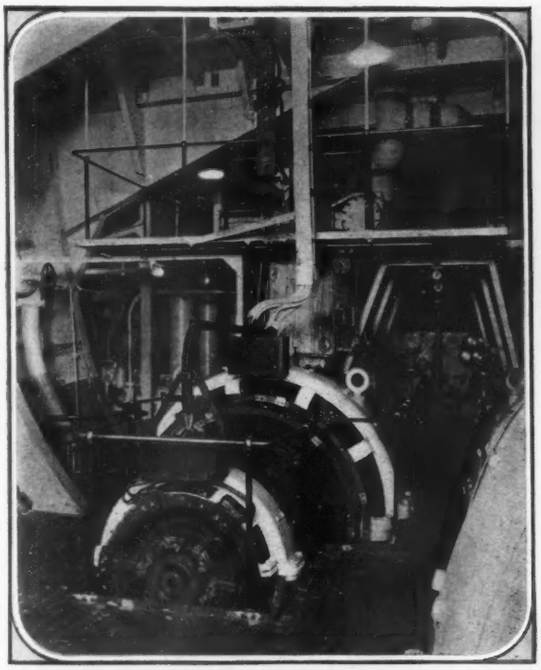
The primary sources of the compressed air used in the various ways mentioned are two Class "PRE-2" compressors, each having a piston displacement of 1,500 cubic feet per minute. Only one machine is in service at a time during the full working period of the office. For night shifts and holidays, the needful air is furnished by one of the two vertical compressors installed for such light loads. These compressors are I-R machines of Type 20, and each is capable of providing 300 cubic feet of air per minute at a working pressure of 50 pounds—the pressure maintained on the line throughout the plant. Since installing these compressors the electric load for compressed air has been reduced 50 per cent. This is only one of the several directions in which mechanical changes have made it possible to effect an annual saving of $65,000.

Largest Oil-Electric Tanker Finishes 18,000-Mile Run on Schedule

THE *J. W. Van Dyke*, the largest oil-electric ship in service—owned by the Atlantic Refining Company, has recently completed an 18,000-mile voyage without refueling. The voyage took the vessel from Philadelphia, her home port, to Rio de Janeiro, Brazil, and then to Durban, South Africa, before she started back to Philadelphia. The *J. W. Van Dyke* was loaded on her outward run with a cargo of gasoline and petroleum products; and her trip is the longest one ever attempted by an oil-electric craft. The performance of the tanker is of much engineering significance; and she was visited at her stopping places by numerous interested experts.

The *J. W. Van Dyke* was originally the *Allentown*, a turbo-geared ship belonging to the United States Shipping Board. Since her conversion from a steamship in May of 1925, including the record-making trip recently concluded, the *J. W. Van Dyke* has logged about 80,000 miles under direct pilot-house control.

The pilot-house control is used at all times at sea, as well as when navigating rivers and other waterways, when threading traffic, and when entering or leaving a dock, and regulates the speed of the propelling motor by varying the voltage of Westinghouse generators. These generators are driven by three Ingersoll-Rand 840-H. P., 6-cylinder, 4-cycle, solid-injection oil engines. By this arrangement, the pilot is in direct control of the propelling mechanism. As this also applies to the steering equipment, the pilot is thus able at all times to control the ship from his station.



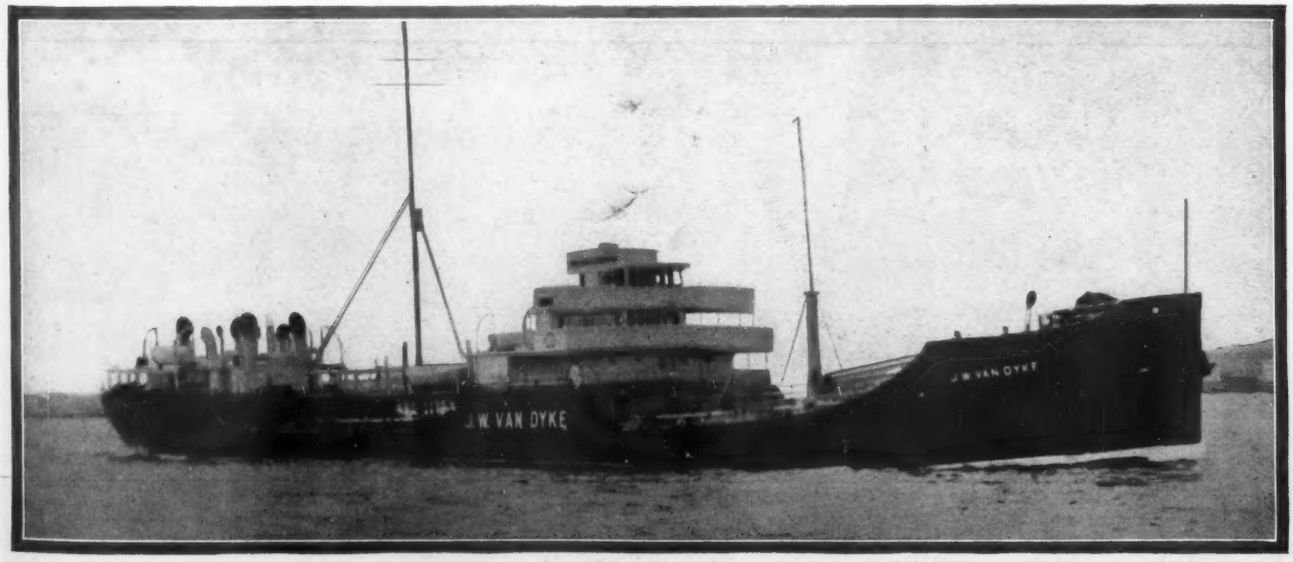
In the engine-room of the "J. W. Van Dyke," showing one of the three I-R solid-injection, marine oil engines that are the primary source of the propelling power.

As oil-electric drive proved very successful in the case of the *J. W. Van Dyke*—having brought about marked operating economies—the Atlantic Refining Company decided to purchase three sisterships, namely, the *John M. Connolly*, the *Bessemer*, and the *Sharon*, from the laid-up-fleet of the United States Shipping Board and to convert them in the same way. To this end, each of these vessels will be similarly equipped with three 6-cylinder, 4-cycle, solid-injection oil engines, of 600 B.H.P., for driving General Electric generators and exciters. Ingersoll-Rand vertical engines, of 50 H.P., will be used to drive the auxiliary generators.

For those interested in figures, it might be added that the principal dimensions of all four of the ships, which were originally built on the same plans at the Gloucester yards of Pusey & Jones, are: length, 380 feet; length between perpendiculars, 365 feet; beam, molded, 50 feet 9 inches; and deadweight tonnage, 7,000.

By changing the *J. W. Van Dyke* from turbo-geared drive to oil-electric drive, the cruising radius of the craft was increased more than 8,000 miles. In other words, instead of her former cruising radius of 10,000 miles, the tanker can now cover 18,000 miles without refueling—leaving a margin for emergencies.

With the completion of the three vessels now undergoing modification, the Atlantic Refining Company will have a fleet of eight oil-electric boats—five tankers and three tugs. This is the largest oil-electric fleet in the world owned by one company; and all the craft are equipped with Ingersoll-Rand multi-cylinder, 4-cycle, solid-injection oil-engines for driving the main generating units. It might be of interest to add that the *Van Dyke I*, *Van Dyke II*, and *Van Dyke III* were the first oil-electric tugs to be used for long-distance coastwise towing.



The tanker "J. W. Van Dyke" is the largest oil-electric-driven ship in the world. She has logged more than 80,000 miles since May of 1925.

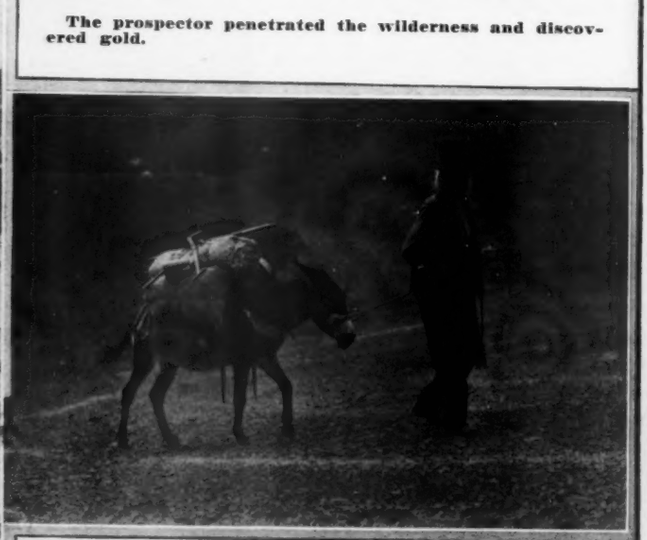
PHASES OF THE HOMESTAKE PAGEANT

Sioux Indians were originally in possession of the Black Hills.

White settlers entered the region back in 1875 after the discovery of gold.

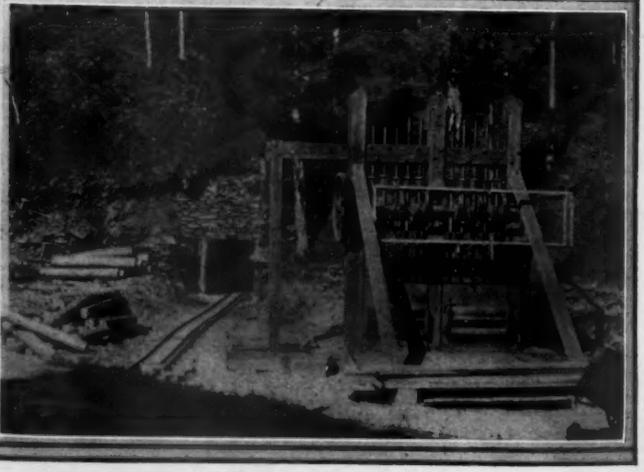
In those days no mining town of the West was without its saloon.

The prospector penetrated the wilderness and discovered gold.



Dancing as they did in the more formal way of the "seventies."

The original stamp mill that handled ore from the Homestake Mine.



Pageant Reviews History of Black Hills

LEAD, S. D., has recently celebrated in a colorful way the fiftieth anniversary of the beginning of gold mining there. Lead, as the atlas shows, lies in the heart of the Black Hills and within a few miles of the town of Deadwood which has provided material for much romantic picturing of the West of frontier days when transportation either by prairie schooner or stagecoach was menaced continually by bands of cruel Sioux who were after booty as well as scalps.

As may be recalled, the Indians entered into the possession of the Black Hills country about 1830; and for a while the Sioux tribe were undisturbed in their enjoyment of that prolific hunting ground. However, the white man's quest for precious metals eventually induced the prospector to penetrate the territory—arousing the resentment of the Indians and inviting in numerous instances mutilation and death. Even so, the seeker after gold and silver persisted in trespassing upon the Indian lands; and, finally, after the discovery of gold there, the United States Government, in 1875, purchased the district from the Indians and opened the territory to the white settlers. From that time on, for a decade or more, the Black Hills furnished thrilling material for many a frontier tale; and much of this history was revitalized for the benefit of the present generation in the pageant which formed a conspicuous feature during the period of Lead's semi-centennial celebration. We are fortunate in being able to reproduce some pictures taken at the time.

Lead has been industrially important for half a hundred years because within the limits of the town is situated the Homestake Mine, operated by the Homestake Mining Company. During its productive career of five decades, the mine has yielded gold to a cumulative value of substantially $200,000,000, and has paid dividends to its stockholders in the sum of nearly $50,000,000. These figures, significant as they are, are not the principal reason for the eminence enjoyed among mines by the Homestake property. Its importance is, in the main, due to the skill of the men that have made the property profitable and, by so doing, have measurably revolutionized mining practices the world over.

Compared with other properties, the Homestake Mine is not a rich one judged by the yield of precious metal per ton of ore brought to the surface. That is to say, the ore is of relatively low value although one that is notably uniform in grade. Such being the case, most people would probably wonder how the mine has paid to work it over so long a period and how it has been able to make such handsome returns. The answer is that both the mining and the milling methods employed have been developed to a high degree of efficiency. In other words, it has been made possible to get great quantities of rock out of the ground at a reasonable cost and then to treat the ore so as to extract from it virtually all of its contained metallic values. This achievement has reacted upon mining activities the world over and, by example, has inspired men to operate properties that might otherwise have remained neglected—curtailing to that extent the aggregate output of the world's precious or essential metals.

We need not remind many of our readers that the low-cost production of ore in the case of the Homestake Mine has to a large degree been due to the extensive employment of air-driven rock drills and to the utilization of compressed air in various other directions. How much rock drills have had to do with the results accomplished will be made plainer if we mention that during one year, that of 1925, the average number of steels sharpened each month was 40,000 for the drifters and stopers and 32,000 for the drills used in blockholing. The Homestake Mining Company has in its service a considerable number of locomotives, operated by high-pressure air, that haul ore both underground and at the surface.

The Homestake semi-centennial jubilee should be an event of more than local interest. Aside from its picturesque aspect as a reminder of earlier days, the occasion brought home to the entire mining fraternity what engineering skill in many departments has achieved in the course of the comparatively short span of fifty years.

Left—Museum in which relics of the early days of Lead were displayed.
Right—The Dance of the Gnomes, who, according to the story of the pageant, planted the gold underground.
Bottom—Some of the interested spectators of the pageant.

Isle of Man Has Modern Fog Horn

By D. Y. MARSHALL

THE Isle of Man, that wave-kissed bit of land in the midst of the Irish Sea, is becoming increasingly popular with the holiday throngs that come from adjacent England, Ireland, and Scotland in search of rest and recreation. Daily, during the summer months, hundreds of vacationists arrive at and depart from Douglas, the capital of this little island of home rule that is justly proud of the fact that it has its own Parliament.

Shipping plying between the mainland and the Isle of Man is kept busy during the height of the season in transporting these seekers after health and pleasure; and, in order to avoid accidents, the Harbor Commissioners have taken every possible precaution to safeguard this ever-increasing tide of passenger traffic. With this in view, they recently authorized the installation of a fog horn that depends for its operation on air power supplied by a compressor rather than the human lungs.

The electrically driven air compressor and timing gear which supply the necessary power to operate the fog horn.

Heretofore, when fog prevailed, shipmasters found it exceedingly difficult to bring their vessels alongside the landing pier. To help them reach their destination under such conditions, it was the duty of the pier master to station himself at the end of a wharf and to act the part of a fog horn. This he did by placing a megaphone over a whistle held between his lips, and then by blowing and blowing as hard as he could until the craft with its precious load had safely come to port. As can readily be imagined, this fog horn had limitations—depending as it did for its efficiency on the lung power of the pier master.

The pier master, Captain George Kelly, blowing his improvised fog horn.

And he, by the way, has remarked in no uncertain terms that "it wasn't an easy job to keep this up for from five to ten minutes." Needless to say, as craft in the waters in question are fairly frequently menaced by fogs, the pier master has gladly resigned the position in favor of the compressed-air fog horn.

The signal now in service consists of a 4-inch Typhon whistle mounted on a quadrant and bolted to the pier head signal-lamp standard. The quadrant mounting allows the pier master to swing the horn through an arc of 180 degrees and to direct the sound toward the incoming ship. The necessary operating air is furnished by a 4¼ x 5-inch, Type 15, electrically driven compressor. This machine loads and unloads itself automatically according to the requirements of the whistle.

The whistle does not blow continuously: it gives three blasts in one minute, each blast lasting for a period of five seconds. This action is effected by the opening and the closing of a valve introduced into the line at a point between the air receiver and the whistle. This valve is made to open against a spring by means of a cam mounted on a shaft, which is driven by a small electric motor through gears at a speed of three revolutions per minute—the cam permitting the valve to remain open throughout the 5-second signaling or blowing interval.

It is but the work of a few seconds to set the fog horn going; and, this done, it will continue to operate without any attention for as long a time as it may be needed. Two switches—one for the compressor motor and one for the timing motor—and a couple of drain cocks are the only controls which have to be touched to start or to stop the signaling apparatus. For a compressor of the size required for an installation of this kind, it is not necessary to have circulating water in the jacket: a reservoir-type jacket, filled with water, is adequate to effect satisfactory cooling.

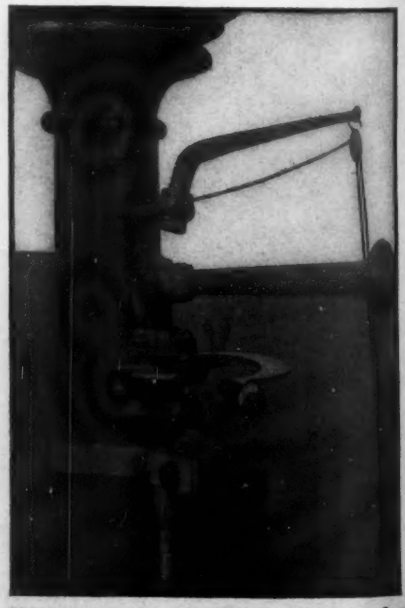
Captain George Kelley, the pier master, is rightly proud of his fog-signal station, which now enables him to "speak" to a ship when it is nearly three miles away from the pier.

What is said to be the largest automatic hydro-electric station in the United States has recently been completed by the Northern New York Utilities, Inc. The power house of the Soft Maple Dam development, in upper New York State, requires no human attendance, as it is controlled by a switch many miles away. The station has a capacity of 20,000 kilowatts.

DESCENDING ELECTRIC CARS DRIVE COMPRESSOR

AS is known, electric trains going down grade, instead of utilizing current, can be made to regenerate current—that is, put power back in the line. An interesting application of this has recently been described in the *Contract Journal* of London.

At the Nidderdale water-power project in Yorkshire, England, a quarry for producing crushed stone, to be used as aggregate, has been established 800 feet above the dam site. The descending electrically driven cars loaded with stone generate more power than is required to empty the cars. The engineers in charge have found a way to utilize this excess power in compressing air for use in the quarry. As the dam is to be 1,800 feet long, 230 feet high, and 135 feet thick at the base, the quantity of stone needed justifies the expenditure incident to this power saving.



Close-up of the new air-operated fog horn showing method of mounting.

Summer Colony Gets Needful Water Supply

Long Stretches of Solid Rock Had to Be Trenched in Extending the Necessary Mains

By A. M. HOFFMANN

GUILFORD, Conn., in the days of its founding, nearly 300 years ago, was a transplanted bit of Old England; and in many ways the town still reflects its origin and boasts of it. As a matter of fact, some parts of Guilford have only lately enjoyed certain forms of modern convenience; and the providing of these is the reason for this article. However, before we tell the story of this seeking after up-to-dateness, let us recall how and when Guilford as a community came into being.

According to the latest census figures, Guilford has a population of approximately 3,200, which is the best evidence that this township, at the mouth of the Menunkatuck River, has prospered and grown in dignity since it was first established by a company of 25 or more families from Kent, Surrey, and Sussex, England, who settled there in 1639 under the leadership of one reverend gentleman, Henry Whitfield.

If surviving documents are to be believed, the Reverend Whitfield was a good bargainer as well as an able religious guardian of the flock in his charge. Soon after the company reached New Haven, in July of 1639, negotiations were started with the Indians of the neighborhood for the purchase of land upon which Guilford was to rise. By September 29, following, terms were agreed upon and a deed was signed by which the Indians conveyed to the independent colonists the territory lying between East River and Stony Creek. The purchase price, so we are informed by the *Encyclopedia Britannica,* was: "12 coates, 12 Fathoms of Wampum, 12 glasses (mirrors), 12 payer of shooes, 12 hatchetts, 12 paire of Stockings, 12 Hooes, 4 kettles, 12 knives, 12 Hatts, 12 Porringers, 12 spoones, and 2 English coates." Other purchases of land were made later in 1639; and before the end of that year the company of colonists moved from New Haven and established themselves upon the land they had bought. The colony was at first known by the Indian name Menunkatuck, and continued so to be called for about four years. After that it was named Guilford in honor of Guilford of the motherland.

Today, this quaint Connecticut township on the shore of Long Island Sound has much to attract the motoring tourist and to gratify its permanent and its summer residents. Even though there is a measure of present-day bustle about its life, still there lurk in many places—especially in some of the side streets, reminders of the Puritan days of the town's birth and vestiges of the domestic habits and conveniences of that remote period. Guil-

Top, left—A stretch of difficult ditching at Vineyard Point. Right—Scattered shallow wells such as this one long provided water for the residents at Point of Rocks.
Bottom, left—The new system furnishes ample water for domestic purposes and for fighting fire. Right—A characteristic bit of the shore as seen from Vineyard Point.

One of the historical features of Guilford, Conn. This structure is said to be the oldest stone house in America.

ford, of course, has its antique shops in which are displayed spinning wheels, writing desks, spinnets, and other pieces of old-fashioned furniture reputed to be genuine relics of the early decades of the settlement. Whether these are veritable remnants of the era in question, it is indisputably true that there is a masonry house in Guilford that dates back to 1639, and which was probably the first permanent home reared in that community, even though it may not be, as claimed, the oldest stone house in America.

Guilford does not thrive because of its historical background. The township is a center of considerable industry. Among its principal productive businesses are the manufacture of iron and brass castings, the turning out of wagon wheels, the fabrication of school furniture, and the canning of vegetables grown in the surrounding country. Near by, and close to the coast, are a number of quarries from which is obtained granite of a fine quality; and it was from one of these that the stone was taken for the pedestal of the Statue of Liberty on Bedloe's Island in New York Harbor.

Because of its beautiful location on Long Island Sound, Guilford has become something of a resort for summer visitors; and at Point of Rocks about 60 families have established a rather select summer community—some of the homes being decidedly artistic and of considerable architectural pretentiousness. The coastal section designated as Point of Rocks has a broken shore line composed of five outstanding projections known, respectively, as Vineyard Point, Eastern Point, Chimney Corner, Sachem's Head, and Uncas Point. All five of these points are washed by the waters of the Sound. Immediately back of the shore area rise a number of hills which give to the setting the added charm of elevation and sweeping vistas.

A lovely shaded street on Sachem's Head.

Beautiful as this picturesque and appreciated hill land is, still the dwellers there have been hampered by an inadequate or at least a limited supply of water drawn for the most part from comparatively shallow wells. Until recently, the members of the colony have at times removed the handles from their pumps so that unauthorized persons could not take water from the wells. The water problem became acute when the management of the yacht club on Sachem's Head decided to install a bath tub. It was recognized that without an ample supply of water the tub would be of little comfort to the members, and, therefore, steps were taken to bring water to the club by tapping the mains of the Guilford-Chester Water Company. For a number of years previously, the property owners at Point of Rocks had tried to get an extension that would tap the mains in question.

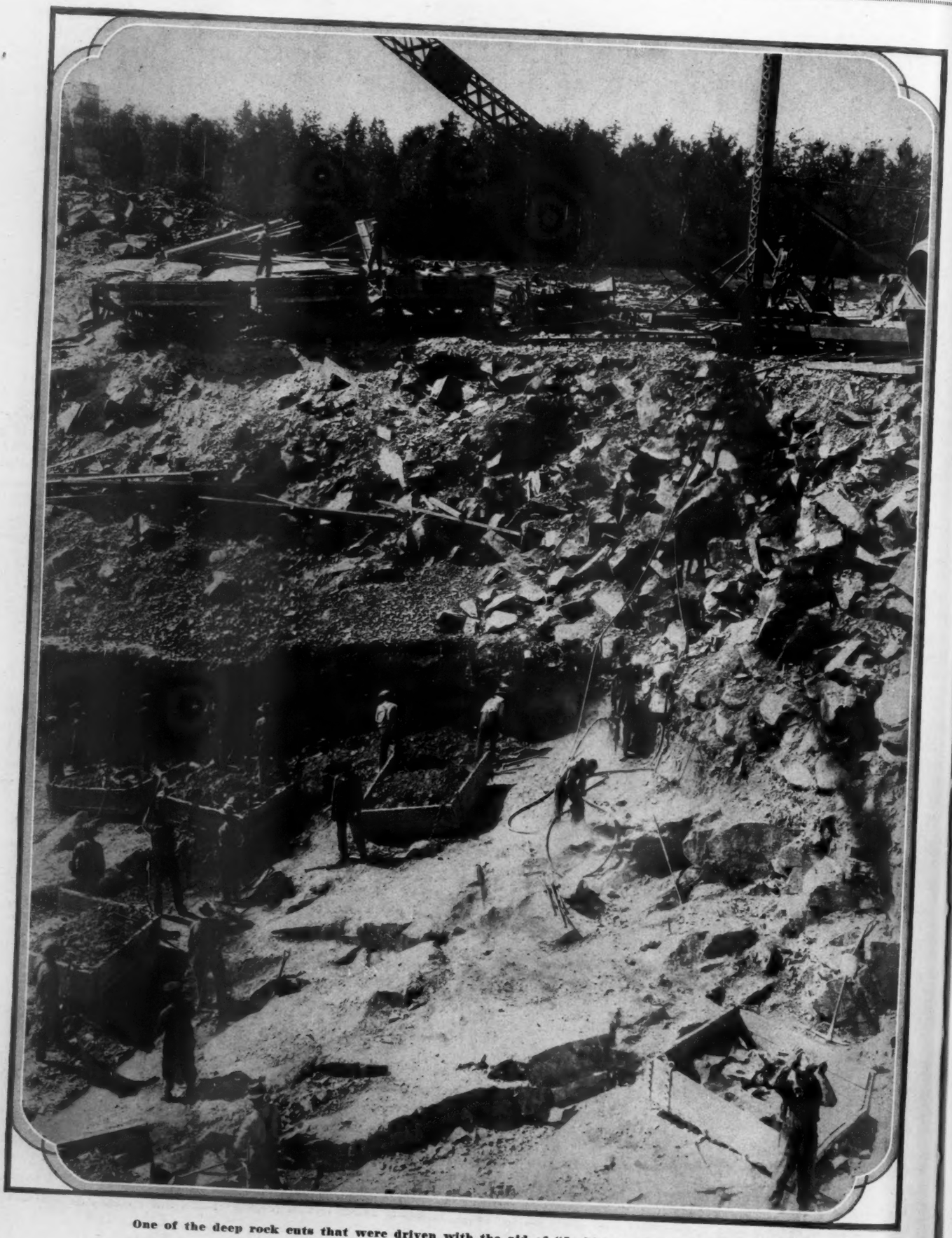
The Guilford-Chester Water Company agreed to extend its system so as to provide the desired relief, and in November of 1925 a local contractor undertook to do the needful work. However, the undertaking proved far more difficult than he had imagined; and, after encountering much rock, he gave up the contract in March of the present year. To extend the water supply to the community at Point of Rocks called for the excavating of a trench 2 feet wide and 5 feet deep; and the original contractor was stumped when he found that his line would have to penetrate a formation of hard and solid granite schist. Before he abandoned the job that contractor laid substantially 4,130 feet of pipe.

About May 1 of the current year, C. W. Blakeslee & Sons, well-known contractors of New Haven, Conn., took over the work; and since then they have finished the undertaking. To appreciate what they have done it might be desirable to mention that the task called for the installing of a pipe line totaling 24,000 feet. About 15,000 feet of this line is of 8-inch pipe, while the remaining 9,000 feet is of 6-inch pipe. Mains are extended from Guilford to the various sections composing the Point of Rocks. The water, noted for its purity, has its source at Killingworth.

The rapid and the satisfactory consummation of the work has been due principally to the fact that the contractor has utilized thoroughly modern equipment in excavating the rock lying in his path. He has had at his disposal four portable compressors which have provided sufficient operating air to drive the twelve "Jackhamers" that drilled the rock preparatory to blasting. And to keep the drill steels fit for the speedy penetration of the hard granite the associate blacksmith shop was provided with a No. 33 "Leyner" sharpener.

Excellent as has been the performance of this modern equipment, no small measure of the progress made has been due to the ability and the experience of Messrs. C. W. Blakeslee & Sons and to the competent direction and untiring efforts of their superintendent, Mr. George W. Hoyle.

Fig. 1—Yacht club on Sachem's Head.
Fig. 2—The broken rock on each side of the trench indicates how necessary modern rock-drilling equipment was in carrying out this water-supply undertaking.
Fig. 3—One of the portable compressors that made it possible t excavate 24,000 feet of trench for the water-supply system now reaching Point of Rocks.
Fig. 4—Part of the residential section of Sachem's Head.
Fig. 5—"Jackhamers" drilling hard rock along the line of the water-supply extension.



One of the deep rock cuts that were driven with the aid of "Jackhamers" and "X-70" drills.

Norman Dam Development

This Canadian Hydro-Electric Project Will Be Able to Furnish a Considerable Block of Power

By A. A. PAOLI and S. T. McCAVOUR*

IN the extreme western part of the Province of Ontario, Canada, there is a watershed covering some 36,000 square miles that offers ideal conditions, because of numerous lakes, for impounding water and for generating electric energy. This entire watershed is tributary to the outlet of the Lake of the Woods, which has an area of 1,400 square miles. Together with lakes Rainy and Mamakan—which have a combined area of about 450 square miles, it will be possible to regulate the discharge of the Lake of the Woods throughout the entire twelvemonth and to take care of year to year fluctuations, except at periods of excessive flow. Records show that excessive flood conditions have occurred about once in every six or seven years.

Until a short time ago but three of the four outlets of the Lake of the Woods were utilized. On two of the smaller and artificially made outlets are situated plants operated by the Lake of the Woods Milling Company, Ltd. The greatest flow is through the eastern and the western outlets, and of these two the eastern one has latterly been enlarged to take care of the requirements of 10 units, each of 1,200 H.P., installed in the Keewatin Power Company's power house situated on this waterway. And now, on the western and main outlet, and on the site of the old Norman Dam, the same company has recently completed the construction of a hydro-electric station conceived back in the early "nineties" when the dam was built. This plant has become the most important of the various water-power developments in the section because of the government's coöperation in the widening of the western channel.

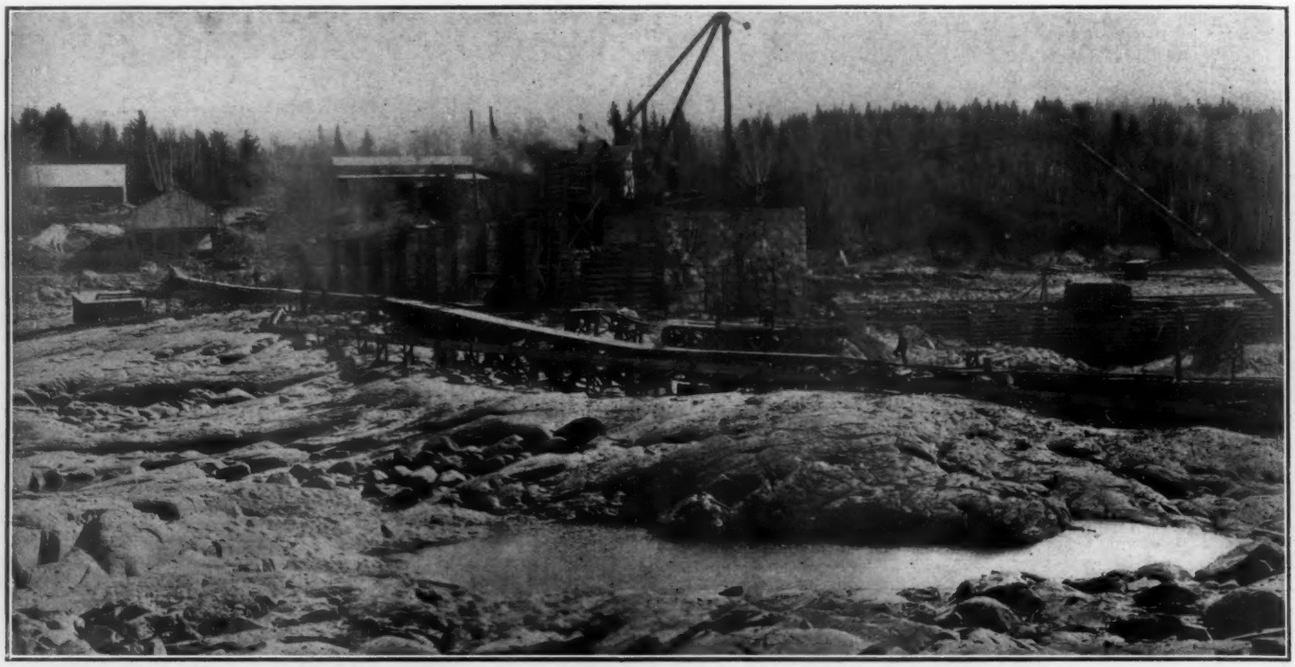
The possibilities of the western outlet were realized years ago, for it was between 1892 and 1895 that the Norman Dam was reared. This dam is situated about half a mile downstream from the Lake of the Woods, and is a stone masonry structure with 20 sluiceways, the sills of which lie about 20 feet below the normal lake level. The central section of the dam was made of rock fill with the thought in mind of later building a power plant there. This has now been done, as just mentioned.

At the time the Norman Dam was built, information was by no means complete regarding elevation, run-off, and discharge conditions. An international joint commission was appointed to make an investigation; and, in 1916, this board recommended that the western channel above the dam be enlarged to accommodate a flow of 40,000 cubic feet a second. The government's object in enlarging the outlet was twofold: first, to increase by 150,000 H.P. the continuous potential power of the Lower Winnipeg River and to benefit power plants on that particular outlet by augmenting their capacity; and, second, to protect property rights—that is, by lowering the level of the Lake of the Woods to prevent its encroachment on the surrounding waterfront.

When the Keewatin Power Company, Ltd., decided to build the power house on Norman Dam, the government promptly undertook the improvement of the waterway. Therefore, the

*Resident Engineer, Backus-Brooks Company.

Rock hard enough to have resisted for centuries the abrasive action of the river has been successfully penetrated by "Jackhamers."



As an indication of progress, these pictures show the

Norman Dam Development, as it is called, really consisted of two distinct contracts, both of which were awarded to the Backus-Brooks Company.

Work on the project was begun in December of 1924; and as the Backus-Brooks Company had both contracts, they promptly began the erection of a cofferdam at the extreme upper end of the channel to divert the discharge of the western outlet. This cofferdam was 760 feet long, and was built to withstand a 20-foot head of water. It was completed within the relatively short span of seven weeks, despite the fact that during the greater part of that time the temperature averaged 30° F. below zero. This was a noteworthy achievement; and was no doubt due, in part, to the use of air-driven drift-bolt drivers, woodborers, and long-stroke drills.

The structure was built in three sections of 8-foot-square crib construction, and was sunk in place by loading the checks with rock obtained from the nearby channel excavation. The entire upstream face of the cofferdam was lined with 3-inch plank sheathing; and by placing toe-filling to a great depth an almost water-tight timber-crib cofferdam was made possible. It was also necessary to provide a downstream cofferdam, and this was so located that it effectually diverted the river from the rock-fill section of the Norman Dam. Because of the irregularities of the bottom at this point the engineers feared that excessive leakage might develop. However, as things turned out, one 10-inch pump sufficed to keep the channel dry after it was unwatered. This downstream cofferdam was 390 feet long; and in construction was like the one upstream.

The job of enlarging the western channel was

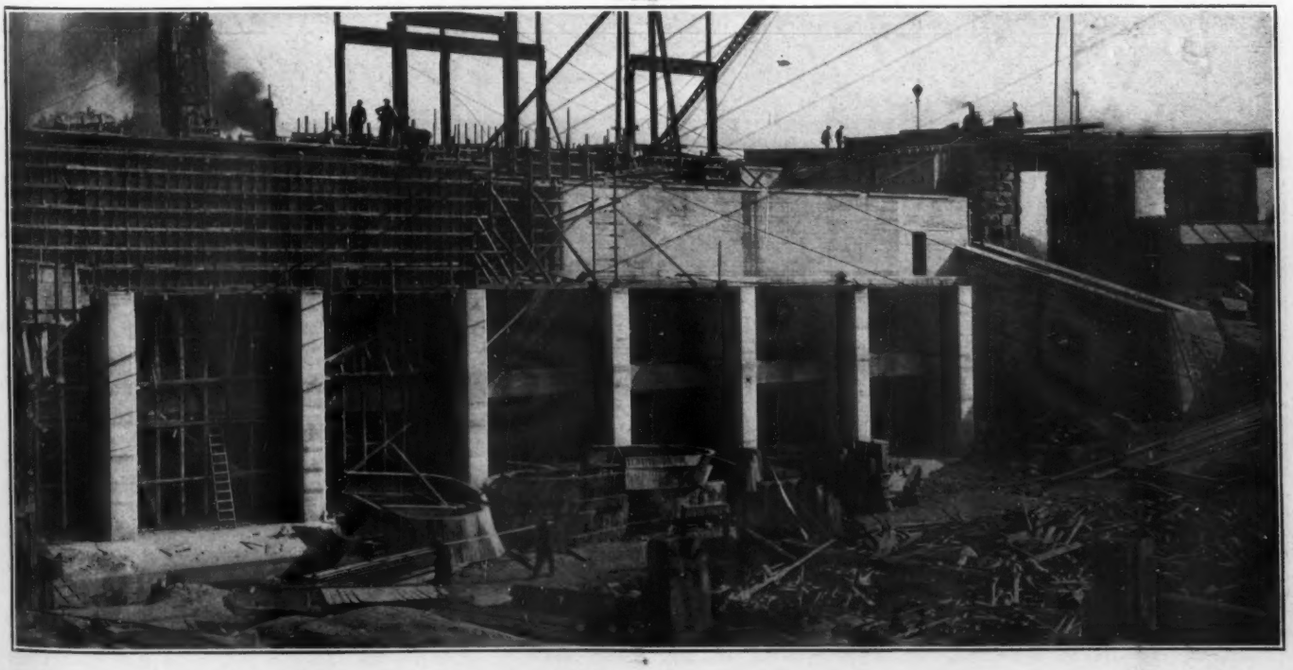
These photographs, taken on September 15, give a

partly completed rock excavation on April 15, 1925.

no sinecure. It involved the digging of a canal, 1,800 feet long, extending from the lake to the Norman Dam. In this work, approximately 50,000 cubic yards of rock had to be excavated at the Rollaway and Twin bridges. It was also necessary to rear two training embankments for the purpose of impounding and directing the flow of the water. One of these embankments is 1,100 feet long and is made up of 27,000 cubic yards of material, while the other is 500 feet long and called for 4,000 cubic yards of earth dug from the bottom of the channelway.

The excavating of the rock in enlarging the western outlet presented many difficulties. Paramount among these was the work at the Twin Bridges of the Canadian Pacific Railway, which necessitated blasting away the rock to a depth of 23 feet. The channel, which is 168 feet wide at this point, comes to within 15 feet of the concrete abutments of the Canadian Pacific Railway bridges. It is said that if these abutments or bridges had been damaged, the Backus-Brooks Company would have suffered very heavy losses.

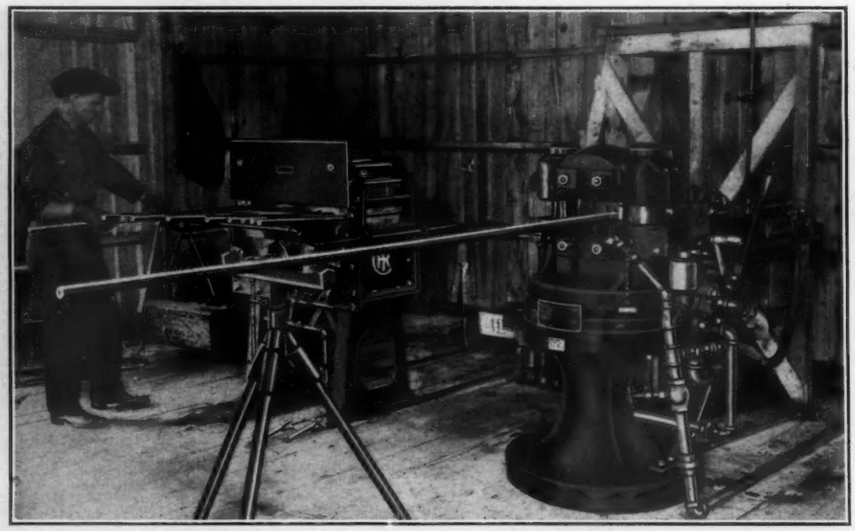
The work of drilling deep holes in the very hard trap rock, granite-gneiss, and green schist was expedited by the employment of two "X-70" Ingersoll-Rand drills mounted on 16-foot demountable towers turned out by the same maker. These drills were equipped to handle 1¼-inch hollow, round steels with "Leyner" shanks. Numerous "Jackhamers," fitted with 1⅛-inch hollow, hexagon steels, were used for surface drilling. Two No. 550 "Leyner" sharpeners with shank and bit punches and two No. 25 I-R oil furnaces furnished a continuous supply of finished steels for the rock drills. On heavy straight-wall excavations, such as the



good idea of the rapidity with which the job advanced.

canal in question called for, it has been the tendency of contractors within the last few years to favor deep-hole-drilling equipment instead of ordinary piston drills and channelers.

The towers of the deep-hole-drilling equipment, as used by the Backus-Brooks Company, are made of structural steel and are so rigidly mounted that accurate alignment of the holes is assured. As all piping is an integral part of the towers, no time is lost in setting them up or in dismounting them. In operation, they are simply moved along intact after each hole has been drilled. This so-called "line-drilling" has brought about notable economies in straight-wall excavating, because it permits more rock to be broken at a single blast and also leaves the wall in a better condition than do other drilling methods.



One of the two steel-sharpening outfits used on the job to take care of the long steels that were required for "DDR" and "X-70" drills.

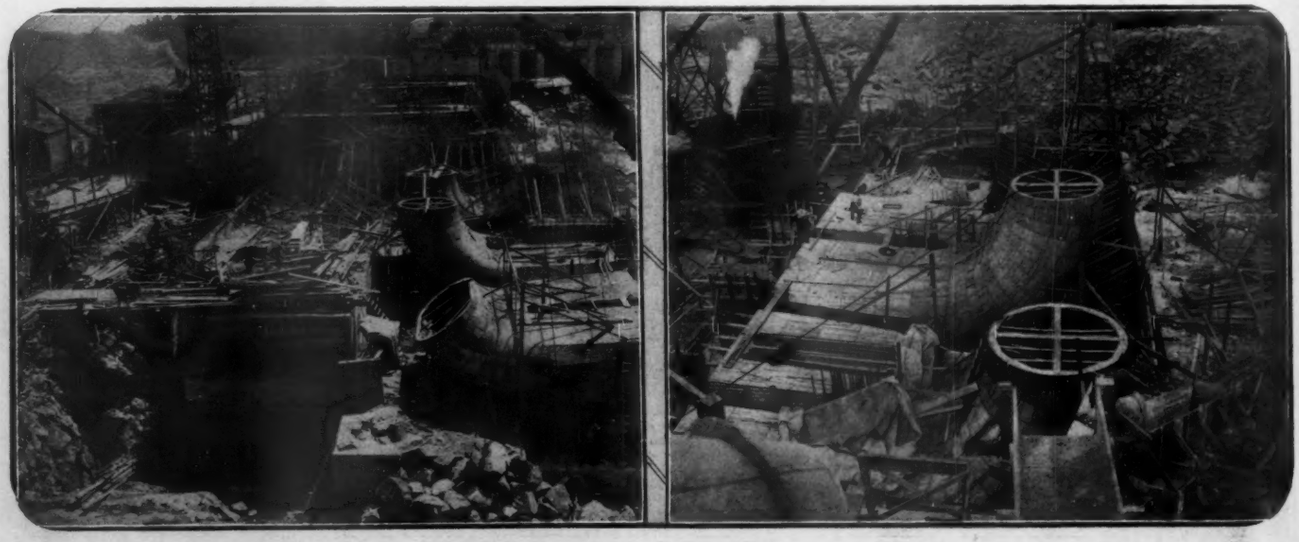
Compressed air for the "Jackhamers," the two tower drills, and the other pneumatic equipment used on the job was furnished by five machines: a 9x8-inch Type Twenty portable driven by a gasoline engine; a 14&9x16-inch, Class C-2, steam-driven, tandem, compound machine; a 14&9x12-inch, Class ER-2, tandem, compound unit; a 16&10x12-inch, Class PLB-2 compressor; and a 14x22-inch belt-driven machine.

The Backus-Brooks Company has compiled some interesting data regarding the quantities of gasoline and lubricating oil consumed by the portable compressor during an active month. The unit was in operation 242 hours, and during that time required 760 gallons of gasoline, or an average of 3.14 gallons per hour. The lubricating oil fed to the crank case of the compressor averaged .04 of a gallon per hour. It is worth noting that, throughout this 30-day period, the portable was actually in operation but a little more than twenty-four 10-hour days. Had steam been used instead of gasoline it would have been necessary to keep steam in the boilers in readiness to start the compressor again when needed —thus adding to the operating costs.

Before work on the Norman Dam power house could be begun by the Backus-Brooks Company it was first of all necessary to repair the sluiceway section of the dam. All the old piers had greatly deteriorated, and the concrete in the sluiceways was entirely washed out. All the joints were therefore carefully raked and grouted; the broken masonry was removed and new stonework put in its place; and new base slabs of carefully tested concrete were poured in all the sluiceways. Holes were then drilled in the sluiceways to a depth of several feet below ledge level and subjected to an "air test." In this way any fissures under the dam were detected and promptly filled with grout.

With these preparatory operations concluded, it was necessary to remove the temporary rock-fill section of the dam, consisting of 40,000 cubic yards of material, at the point where the power house was to be built. Much of this material was used later on as a coarse aggregate in the construction of the power house. In laying the foundation for the power house, a total of 35,000 cubic yards of concrete was required. This substructure is 310 feet long, 89 feet wide, and 70 feet high at the deepest section. The intakes, scroll cases, draft tubes, fish ladders, and trash sluice are all of reinforced concrete. For the large unreinforced masses below the draft tubes and the intakes a 1:2½:5 mixture was used, and for the reinforced sections a 1:2:4 mixture was specified. The superstructure is composed of brick with a structural steel frame; and both the roof and the floors are of reinforced concrete. As completed, the structure is 303 feet long, 83 feet wide, and 48 feet high.

In erecting the power plant provision was made for seven units, of which five have been installed to date. These units are single, vertical, wicket-gate turbines arranged for direct connection to generators; and the gates are operated by an actuator type of governor. Each turbine unit has an intake with three water passages. These passages, each of which is 10 feet wide, are separated by 3-foot walls—making a span of 40 feet from center to center of adjoining units. At a 24-foot head a power



Interesting close-ups illustrating stages of the construction work on the power house.

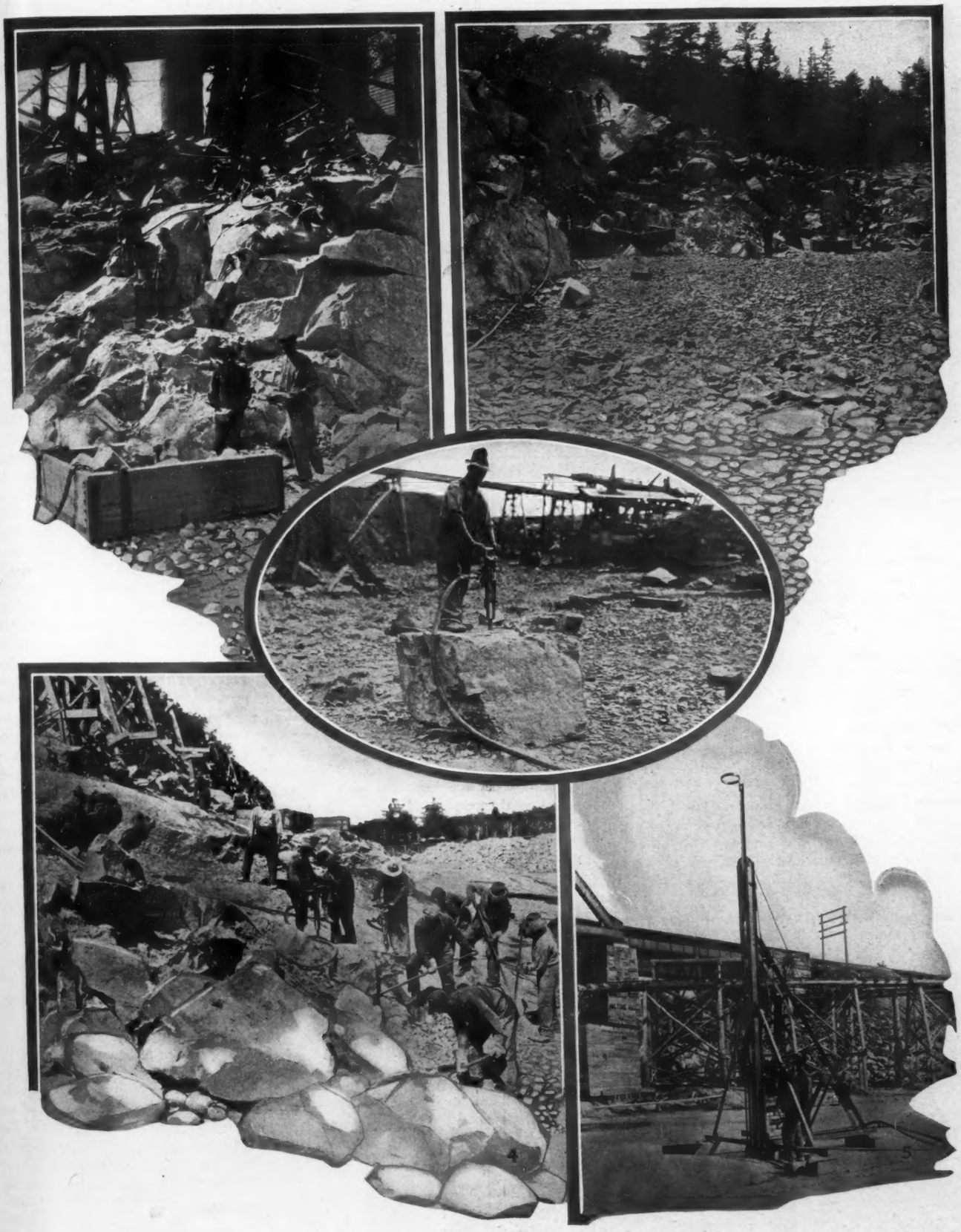
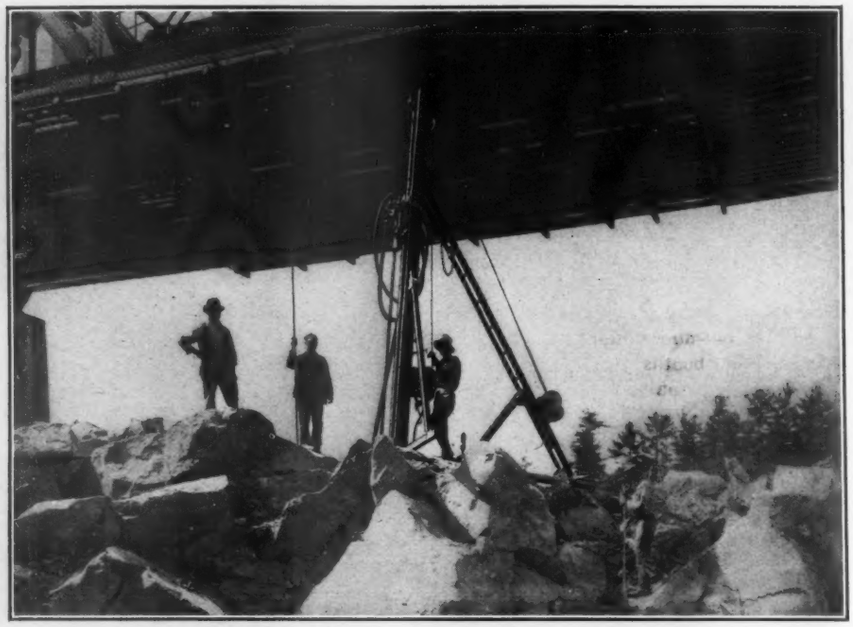


Fig. 1—Rock cut at West Bank Traffic Bridge.
Fig. 2—Mucking rock from the upstream side of the dam.
Fig. 3—Blockholing a large piece of hard rock in the river bed.
Fig. 4—In breaking up the rock of the bared river bed, DDR-13 "Jackhamers" proved very effective.
Fig. 5—An "X-70" drill, mounted on a 16-foot tower, drilling holes in the rocky bed of the diverted river.



Making a 23-foot rock cut in the bed of the diverted river beneath the Main Line Bridge of the Canadian Pacific Railway. A 16-foot demountable tower was used to carry the "X-70" drill employed in the necessary deep-hole work.

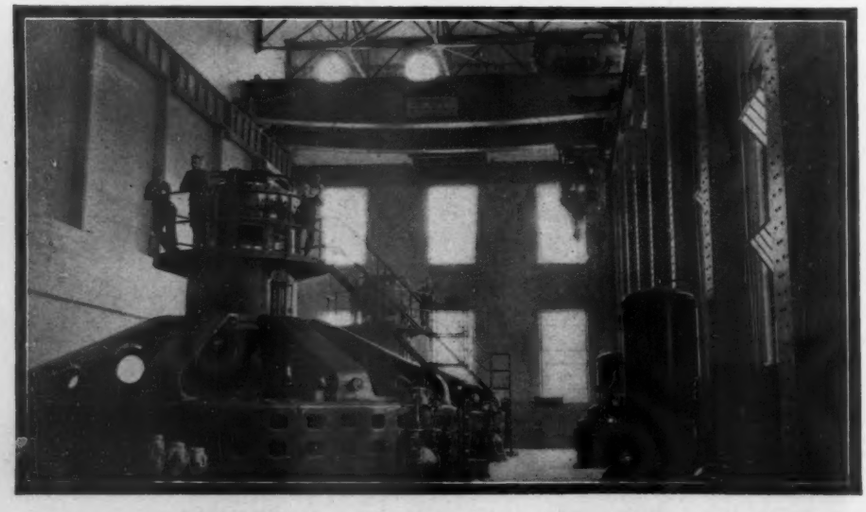
output of 3,775 H.P. is obtained at full gate, with an efficiency of between 89 and 90 per cent. at best gate; and at a 16-foot head there is an output of 2,250 H.P. at full gate with an efficiency in excess of 85 per cent. at best gate.

The present generator installation consists of five 3,300 Kv-a. Canadian Westinghouse units producing 3-phase, 60-cycle current of 6,600 volts when making 120 revolutions per minute. The efficiency of these generators at 100 per cent. power factor is approximately 95 per cent. at full load, and 93.5 per cent. at 90 per cent. power factor.

The power generated by the Norman Dam power house is being delivered to a paper mill owned by the Keewatin Lumber Company, Ltd., located in Kenora, Ont. The transmission line is two miles in length; and for use at the mill the current is stepped down to 220 volts. When units No. 6 and No. 7 are installed at the station another circuit will be added.

A good deal of the credit for the rapidity with which the Norman Dam job was carried to completion is due to Mr. J. T. McLellan, Construction Manager, Backus-Brooks Company.

Deposits of potash have been discovered in Russia that are said to be as large as those worked in Germany. In fact, systematic borings near Solikamsk, in the Perm District, have already revealed the existence of 100,000,000 tons of this mineral. According to the *Taegliche Rundschau*, the Russian government is making arrangements to work the property.



Generator room, where the power in descending waters is converted into electrical energy.

MAKING OUR DOLLAR BILLS LAST LONGER

CONSIDERING that the life span of one of our dollar bills—of which the greater part of our currency is made up—has been growing shorter and shorter of late years, it is not surprising to learn that efforts are being made to improve its wearing quality. In the past, with average usage, a "greenback" lasted about twenty months, whereas, until fairly recently, it was ready to be withdrawn from circulation after six months' handling. This is a serious matter, in view of the fact that there is in use today three times as much paper currency as there was fifteen years ago.

Just what this means can be more fully appreciated when it is understood that 1,000,000,000 new bills, weighing more than 1,200 tons, must be made annually to replace worn-out currency—the cost of this replacement having mounted to $4,000,000 each twelvemonth. This tremendous outlay was not the only thing that concerned the Treasury Department. Unless something could be done to cut production, the Department was faced with the necessity of making costly additions to its paper-currency printing plant.

While the chief contributing factors to the wear and tear are rapidity of circulation and carelessness in handling, it has already been brought out that the use of an all-linen fiber was in part responsible for the inability of the paper to withstand repeated folding. By substituting 25 per cent. cotton fiber, it has been possible to strengthen the paper and thus to give the bills more folding endurance. Both the paper-manufacturing processes and the printing processes are being studied; and it is said that the work already done has resulted in more than 50 per cent. improvement in the wearing quality of paper currency—this improvement being mainly due to the fiber modification and to a change in the surface sizing of the printed bills. In the past, animal glue alone was used for surface sizing; but by hardening the glue with formaldehyde the wearing resistance of paper money has been increased.

Still further betterments are promised; and it is believed that, besides meeting the increased demand for paper currency with reduced expenditures, the work will be of value in the general technique of paper making. The work is being conducted by the Treasury Department in coöperation with the Bureau of Efficiency, and Crane & Company.

The possibility of producing petroleum from vegetable matter was recently made the subject of an address before the American Chemical Society by Prof. James F. Norris of the Massachusetts Institute of Technology and president of the society. Professor Norris brought out that scientific investigation has proved that one type of petroleum at least has been traced to vegetable matter that was converted into marsh gas and finally into higher hydrocarbons. "The formation of hydrocarbons from vegetable material through the action of bacteria or other agencies will some day be studied," he said, "and the result may lead to an important industrial development."

British Quarry Managers Association Stages Interesting Exposition

By A. LONGHURST MURPHY

WHAT has so far proved to be one of the most interesting expositions of the year in the British Isles was that held not long ago at Llandrindod Wells, Wales, under the auspices of the Quarry Managers Association of Great Britain. It had been realized for some time that there was need for an exposition devoted to quarrying and to its allied industry, roadbuilding. It was therefore decided to hold such an exposition in 1926 at the time of the Annual Conference of the Institution of Quarry Managers.

The picturesque little town of Llandrindod Wells, centrally located in Wales, was chosen as the place best suited for the event; and manufacturers of quarrying and roadbuilding equipment were invited to exhibit. A field was kindly put at the disposal of the promoters by Mr. Thomas Lant, J. P., one of the largest quarry owners in the country; and preparations were made to get the ground in readiness. It was believed at the start that about 100 tons of machinery would be exhibited, but by the opening date over 600 tons of tools and plant equipment had been set up. This unexpected participation was mainly due to the untiring efforts of the organizers, although unusually favorable weather conditions contributed much to the success of this out-door affair.

Nearly all the booths were in readiness at the time of the formal opening. This ceremony was performed by Sir Henry Maybury, K. C. M. G., C. B., Director General of Roads and Minister of Transport, accompanied by Mr. Lant and other distinguished officials. As was to be expected at an exposition devoted in part to roadbuilding, air-driven rock drills were conspicuous among the tools exhibited. These drills, as well as some of the other machinery, were shown in service condition, thus adding measurably to the interest of the visitors.

Realizing that good shanks and bits on drill steels are of paramount importance in getting the most out of rock drills, one of the exhibitors, the Ingersoll-Rand Company, decided to give over the largest part of their space to a "Leyner" drill-steel sharpener and necessary accessories. In fact, a model working plant was set up consisting of a pneumatic drill-steel sharpener, a No. 25 oil furnace, and a No. 8 pedestal grinder. The installation being a temporary one, air was supplied by a portable compressor.

This exhibit attracted a great deal of attention, quarry owners and managers, especially, being interested in the ease and the speed with which perfect bits and shanks could thus be formed on drill steels. Much valuable information was given regarding correct heat treatment of steels; and by first explaining the process in theory and then showing how the sharpener and associate machinery do their work, step by step, it was possible in a very short time to prove to the spectators that machine-made drill steels, aside from being turned out faster, are superior to those sharpened by hand.

Next, some of the finished steels were successively fitted in a "Jackhamer," and holes were bored in a large piece of rock to show what well-sharpened steels can be counted upon to do. Besides a line of rock drills, ranging from the smallest "Jackhamer" to the

The extemporized blacksmith shop proved an unfailing attraction. Here the "Leyner" sharpener, especially, caused astonishment by the rapidity with which it could put proper shanks and bits on drill steels.

Air for operating the drill-steel sharpener, the oil furnace, and the pedestal grinder was furnished by a portable compressor.

largest "X-70" deep-hole hammer drill now so well known in British quarries, the Ingersoll-Rand Company exhibit included other quarry and roadbuilding tools and machinery.

Conspicuous among the heavy machinery, such as crushers, mine and quarry locomotives, etc., was a paraffin locomotive manufactured by the Muir Hill Equipment Company, Ltd., of Manchester, England. This tractor is fitted with a 2-speed foolproof gear box giving speeds of from 4½ to 7 miles per hour. It is claimed that the locomotive has a maximum haulage capacity, on the level, of 132 tons on 20-pound rails. A locomotive of this type was shown in operation on a track encircling the exposition grounds.

The Cambrian Waggon Company, Ltd., of Cardiff, had a businesslike exhibit including their patent 2-body side-dumping wagon which can be tipped at three different angles to discharge different kinds of material. In the booth of Messrs. Ropeway, Ltd., was an ingenious working model of an aerial ropeway. This company has had wide experience in the erection of conveyors of this kind, and has to its credit a ropeway that is 47 miles long.

As previously mentioned, the exposition and the Annual Conference of the Institution of Quarry Managers were arranged to take place conjointly—each adding materially to the interest of the other event. The meetings of the association were presided over by Mr. Grace, Director of the Enderby & Stony Stanton Granite Company, Ltd., operating one of the biggest quarries in England. At these meetings the many problems that beset the quarry industry today were discussed from all angles. The pros and cons of the cost of production, of overhead, and of maintenance, as related to output, were gone into thoroughly in an endeavor to arrive at some working basis that would make for greater output at lower cost.

One of the most enlightening contributions to these discussions was made by Mr. Edward Dalton, Manager of Scatter Rock Macadams, Ltd., a quarry near Christow, in Devonshire. Perhaps the readers of this Magazine will remember an article written by Mr. Dalton, entitled *Getting Out the Toughest Rock on Record,* that appeared in our December, 1925, issue. Mr. Dalton's address had to do with the economies made possible in quarrying by a "POC-2," direct-connected, oil-engine air compressor; and before reading his paper he told the members that he was going to be perfectly frank and back up his statements with exact cost and production figures. Limited space does not permit us to enter into the matter at this time, but the Magazine hopes soon to be in a position to publish the full text of this valuable contribution to the literature on quarrying.

Another paper that provoked much comment was read by Mr. G. E. Heath, a well-known consulting engineer, who is identified with Carels Diesel & Steam Engines, (London), Ltd. In his paper, entitled *Economic Power Supply,* Mr. Heath contrasted oil-engine drive with gas, steam, and electricity, supplied by public utilities, as applied to the quarrying industry. In view of the present coal strike in England, the comparisons were very pertinent; and there is without a doubt a distinct move in favor of the oil engine because it has indisputably proved to be an economical prime mover.

Activities at this exhibit always held the attention of a crowd of quarry men and contractors.

WINDMILLS TO GENERATE ELECTRICITY

WINDMILLS, which have so long been a picturesque feature of the landscape in Holland and Germany are, in a new form, to continue their time-honored record of service. True, while the new windmills may not have the artistic value of their predecessors, still they will be more pleasing to the eye than most other sources of mechanical power generators.

At a recent meeting of the Dutch Royal Institute of Civil Engineers it was brought out, so we learn from the *London Morning Post,* that "aeronautical experts have been working on the production of a new kind of windmill that promises to be many times more efficient than the older type. Such progress has been made that it is now thought possible that windmills, instead of disappearing, may be used in steadily increasing numbers.

"Already one of the foremost Englishmen of science, writing of the future, has prophesied that England will eventually be dotted with aerodynamically efficient windmills that will generate electricity sufficient for all purposes. One of the chief difficulties so far encountered has been to develop a satisfactory type of storage battery for use in conjunction with the fluctuating output of windmills. The new windmills will vary in shape and general construction, but the tendency is to use four tapering blades carefully cambered like the wings of an aeroplane. These blades will be mounted, on ball bearings, behind instead of in front of the tower supporting them."

Choice, Care, and Service Operation of Air-Driven Tools

PART II

By F. A. JIMERSON

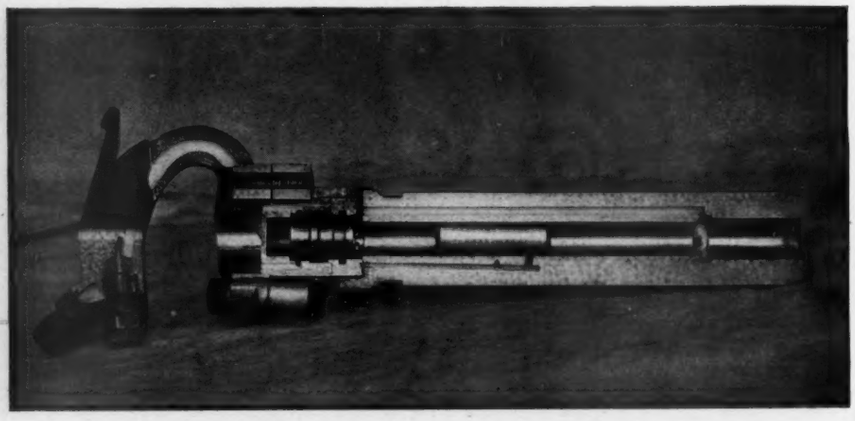
THE usual practice has been to make small drills of the 4-cylinder V-type like the larger machines described in the foregoing installment of this article. The smaller machines usually give more trouble and are less accessible for repairs. Operating speeds are higher, parts are not only smaller but lighter, and proper lubrication is more difficult. As feed screws are rarely used with a small machine, there is no good reason for retaining the 4-cylinder V-type machine. One of the most successful small drills is made with three radial cylinders, equally spaced, and with all three connecting rods operating on the same crank pin. The valve is on the main crank between ball bearings, which save the valve and the bushing from wear. This is a simple and rugged design readily accessible for repairs. The cylinders are renewable and interchangeable, and no expensive parts are necessary to keep the machine in economical operating condition.

Grinding machines are commonly modifications of standard 4-cylinder drills. However, the most popular grinder today uses a 3-cylinder radial motor similar to that in the small drills just mentioned. These machines usually operate well-nigh continuously at high speeds; and therefore the need for a rugged grinder that can be easily maintained is apparent. On the other hand, wood-boring machines are modifications either of the aforementioned 4-cylinder or 3-cylinder machine. One manufacturer has successfully used aluminum cases for years, thus producing a lighter borer than is otherwise obtainable.

Corner drills or flat drills, as they are variously known, are intended for working in restricted spaces not accessible to the standard types of drills. One of the oldest and most satisfactory machines of this kind uses a 2-cylinder, double-acting motor with two piston valves operated by eccentrics. The motor is geared to a second 2-throw crank which actuates two ratchet levers. The spindle is driven by these two ratchets, which produce an intermittent motion. This type of drill is compact and has good torque, but is considerably slower and develops less power than certain other designs. There is another machine that is similar to the one just described except for the spindle, which is driven by a train of gears giving uniform motion. The operation is good. The principal trouble with this drill is due to the heavy loads on the final drive gears and to the fact that the plain bearings employed carry high unit pressures. This type can be made reversible, whereas ratchet-driven machines, strictly speaking, cannot.

Top—A No. 9 close-quarter drill reaming holes in a locomotive guide yoke.
Left—Drilling holes for hinge screws in the door of a refrigerator car.
Right—Drilling rivet holes through members of a chassis in an automobile plant.

Still a third type has three cylinders with the pistons connected directly to three long ratchet levers. The pressure of the air on the pistons is therefore transmitted right to the spindle. Owing to the use of three ratchets, the motion of the spindle is continuous rather than intermittent. This drill has good torque, and runs at a higher speed and develops greater power than the 2-ratchet type. It is simple and rugged in design, and is well adapted for heavy work.



Longitudinal half section of an "A" type riveting hammer.

It is difficult to outline satisfactory rules for selecting riveting hammers because the personal element enters to such an extent in trial tests that such tests are rarely reliable. Most operators prefer the kind of hammer to which they are accustomed: they get used to the "feel" of it, and work along continuously without undue fatigue. Give them another hammer to try and they will very likely lay it aside shortly. When questioned, they will probably say: "Holds hard," "too much push," "kicks," or something like that. Under those conditions, to antagonize operators is to secure an unfavorable report, if not one that pronounces the hammer an absolute failure.

A comparative test of riveting hammers, assuming all to work reasonably well, should be undertaken only after the men have become accustomed to the tools. With satisfactory test conditions secured, it is well to make comparative time studies—that is, to determine the average time required to actually drive rivets, as well as the percentage of time that the hammers are in service. Frequently, the actual driving time per rivet has little to do with the number of rivets driven per day. Time studies of riveting operations will often bring to light means of speeding up the work as well as furnishing a basis of comparison for the hammers. It goes without saying that all results should be tabulated for study and reference.

In selecting hammers, the following things should be kept in mind:

Are they easily accessible for repairs?

Are they likely to be damaged in assembling or disassembling?

Are all wearing parts, such as the bore of the barrel and the valve box, hardened and ground? Cheaper hammers are frequently reamed from a high-carbon steel but are not hardened or ground.

Are there any plugs in handles or barrels to come loose and give trouble?

Are there any unnecessary links or pins in the throttle mechanism that will wear?

Are the throttle valves of a type that will remain tight indefinitely?

Can throttle valves and bushings or guides be renewed readily?

Is the handle integral with, screwed on, or bolted to the barrel? With integral construction, damage to or breakage of either the handle or the barrel generally means a new hammer. With screwed connections, handles usually loosen somewhat after short usage, and unless tightened will cause damage to the threads and faulty functioning of the tool. With bolted construction, there is enough elasticity to a heat-treated bolt to keep the joints sufficiently tight for proper operation. Bolts may possibly break, but they are easily renewed at low cost.

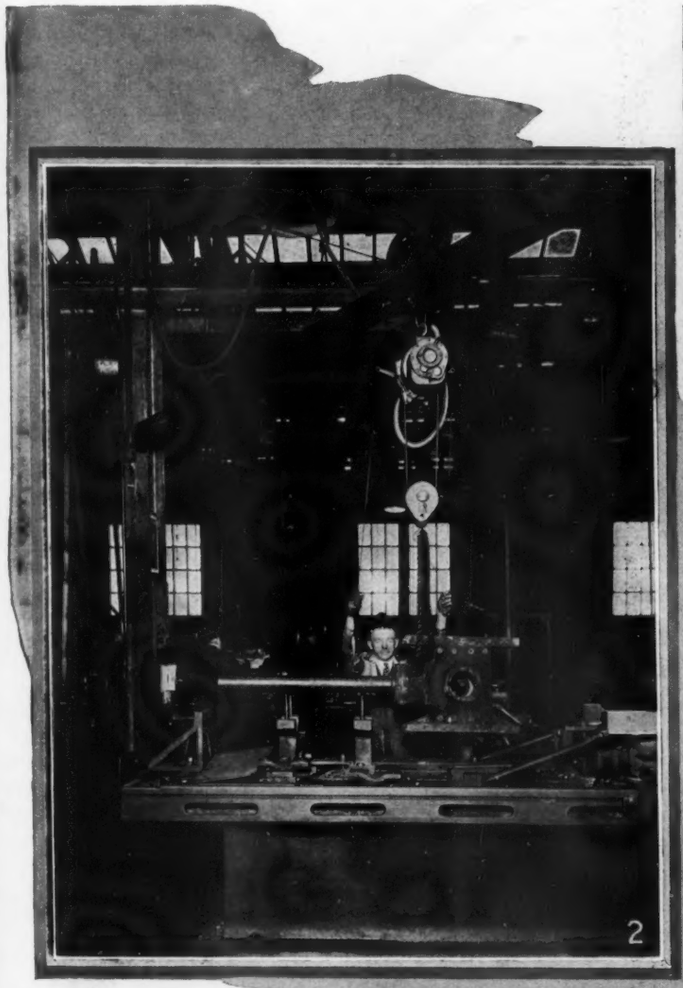
Is the air consumption low, and does it remain well-nigh constant after reasonable service?

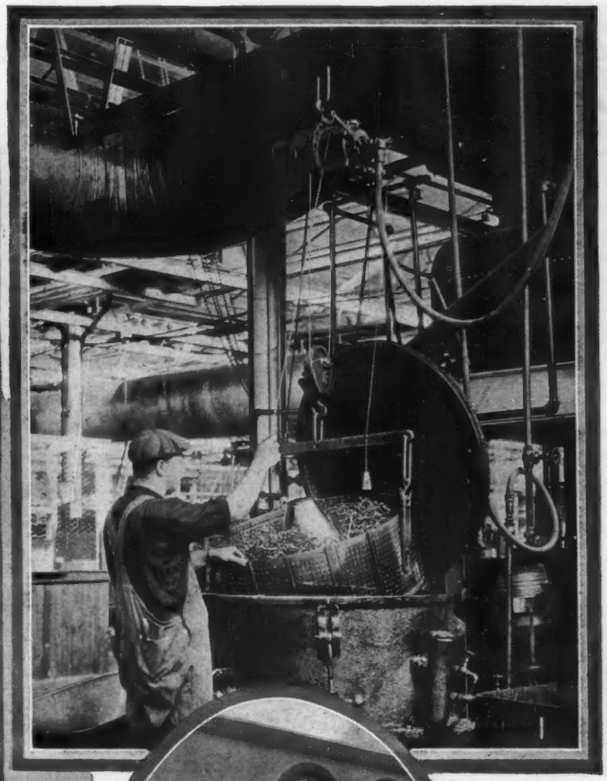
What is the operating speed of the hammer with varying lengths of pistons?

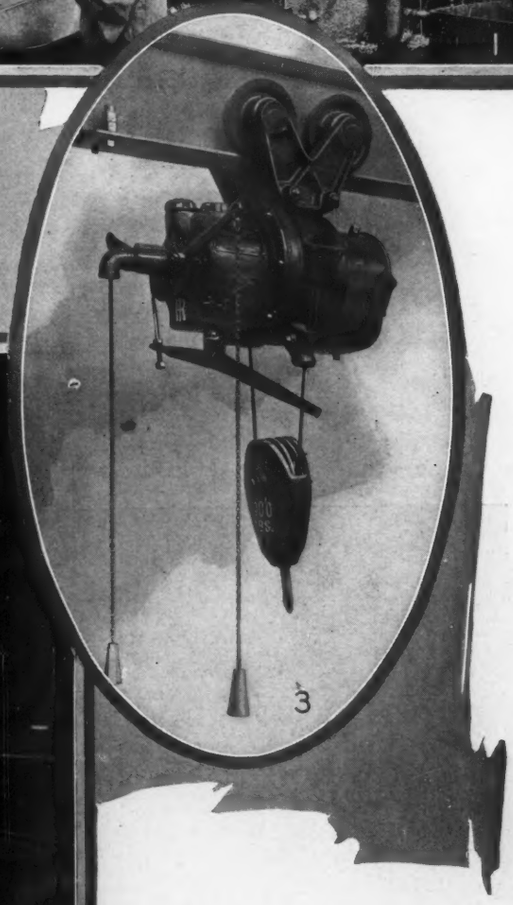
The best check on the condition of a hammer is a comparison of its service speed and air consumption with its speed and air consumption during a test made of the same tool when new.

Substantially all that has been said regarding riveting hammers applies with equal force to chipping hammers. In selecting chipping hammers it is well to recognize that different classes of work require different types of hammers. A comparatively slow, hard-hitting hammer is very suitable for mild or soft steel, cast iron, etc. High-carbon billet work

Left—Driving ⅝-inch rivets in the steel end of a box car. Right—Using a "6A" riveting hammer and a 9/16-inch set in driving hot ½-inch rivets in the chassis of a motor truck.







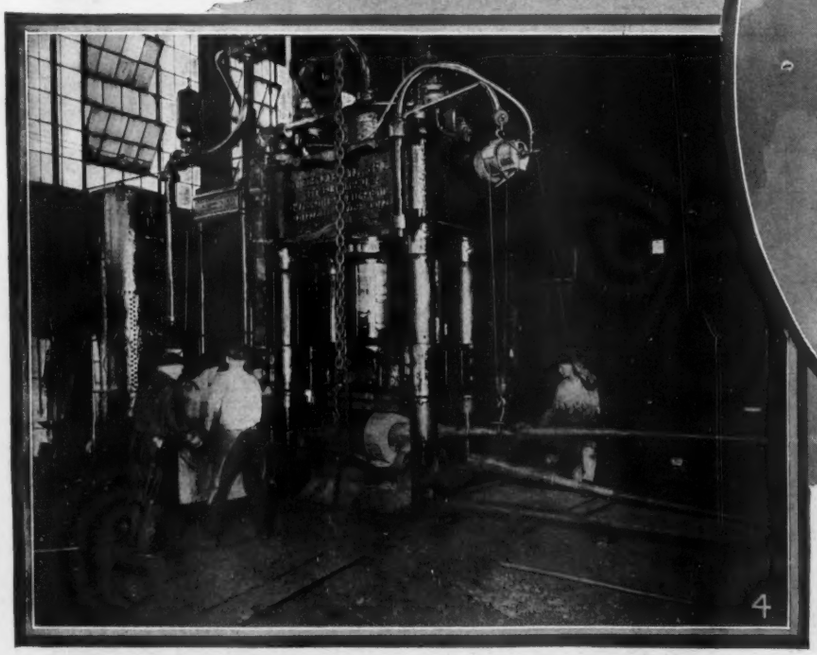


Fig. 1—Air-motor hoist used for lifting a chip container from an oil separator.
Fig. 2—The air hoist has proved a handy labor saver in the machine shop.
Fig. 3—Type of air hoist most extensively used today.
Fig. 4—Air hoist in service in a forge shop.

calls for a fast, snappy blow. The fast hammers are usually best adapted to steel-casting work, which involves considerable sanding or cleaning. If employed for these purposes, the piston should be well cushioned with air at the front end to prevent damage to the barrel when the hammer is allowed to "ride" or play off the shank of the chisel.

In using chipping hammers, it is the part of economy to renew the nozzles as soon as they show appreciable signs of wear. Worn nozzles waste air and reduce the speed and the power of the tools. Many hammers hold easier after they have become worn; and for that reason operators may not turn them in promptly for repairs.

It is rarely good business to buy any tool on account of its price. This is particularly true of sand rammers. Two rammers may look alike, run at the same speed, and use the same amount of air, but one may outlast two of the others. In choosing sand rammers, it is important to see to it that the tools strike with positive, hard, fast blows; that the air consumption is reasonable; and that they will function properly with varying air pressures. Next, one should ascertain if all wearing parts are thoroughly hardened and ground; if the manufacturer can furnish standard oversizes for pistons; and if he will regrind barrels at a moderate cost. Few other tools operate under such adverse conditions as regards wear, and for that reason frequent cleaning is desirable and regular lubrication is essential.

General utility hoist, size "DU," always ready for service wherever a load is to be moved.

Pneumatic hoists are an important class of air-operated machines that are often overlooked. The direct-acting plunger type is a familiar one, but is unsuited for many purposes. The earlier air-motor hoists did not meet with great favor, but the more modern types are finding extensive use in foundries, machine shops, warehouses, paper mills, dye houses, etc. Their first cost is low; their operating cost is almost negligible in the case of the average installation; their maintenance cost is distinctly less than that for electric hoists; and they are absolutely safe in service.

The modern air-motor hoist is particularly suited for foundry work or in other places where loads must be handled without vibration or jar, and where control must be sensitive and positive. Air hoists of small capacities are being widely used today instead of hand-chain blocks. They are adapted for swing machine tools or for similar work. They lighten manual labor, and in many cases may be employed to advantage wherever materials, etc., have heretofore been lifted by hand.

Pneumatic hoists are of spur- or worm-gear drive with motors of various types. The prime requisites in a hoist are: reliability, freedom from vibration, and nicety of control. Compactness of design and accessibility for the purpose of repairs are important. Positive holding of the load at any point is essential. All types must be provided with positive brakes, as even the worm type will not hold its load under all conditions unless inefficient worms are utilized.

One of our illustrations shows the kind of hoist most extensively used today. The quarter- and the half-ton sizes of this type are made with three cylinders, but the larger sizes have four radial cylinders. The motor is lubricated by a big disk mounted on the crank shaft, which dips in oil in the bottom of the motor case. The oil is carried to a pocket, whence it flows to an annular groove cut in the crank web. From this groove it is fed by centrifugal force through the drilled crank pin outward to the connecting-rod bearings. The crank is mounted on standard ball bearings. The smaller sizes have spur-gear reductions, while the larger hoists are provided with differential planetary gearing giv-

**Left—Ramming the cope for a pit mold with air-operated floor rammers.
Right—Chipping hammers at work on large iron castings in a foundry.**

ing a compact, strong, and efficient reduction unit. Ball bearings are used freely.

Another type known as size "DU", is a general utility hoist—that is, it is ready for service wherever a load is to be moved. While primarily designed to suit the needs of contractors and to be employed in conjunction with portable compressors, it is well adapted for the work of millwrights and repair gangs.

Those that use pneumatic tools in considerable numbers will find that a well-equipped repair department, provided with tools for repairing and apparatus for testing, will do much towards keeping both the operating and

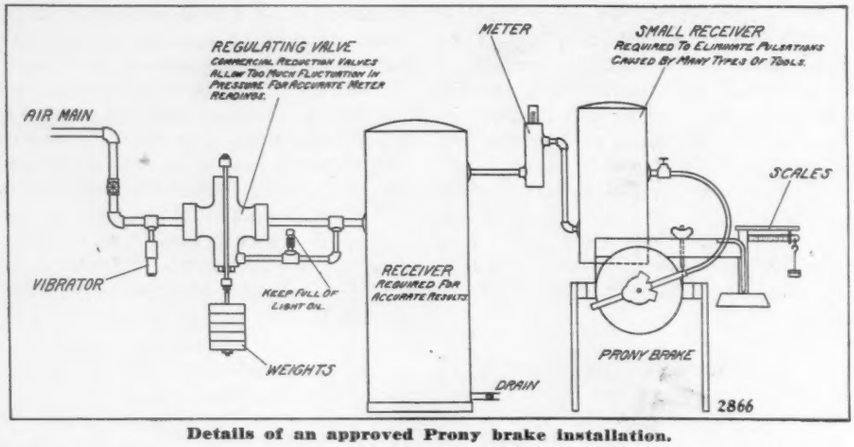
Top, left—At the final inspection bench, in the plant of an up-to-date pneumatic-tool producer, every heat-treated part is tested for hardness. Right—Manner in which chipping hammers are tested by the manufacturer.
Bottom, left—Inspecting plug gages in the tool room of a pneumatic-tool manufacturer. Right—Grinding plug gages to precise dimensions to insure accuracy in the manufacture of pneumatic tools.

the maintenance costs of such tools at a low figure. Such a department should be centrally located in a clean, light place, and should be thoroughly systematized. There should be adequate space in which to store a suitable supply of spare parts; and the necessary spare parts, as well as the special tools for repair purposes, should be bought from the manufacturer at the time the pneumatic tools are purchased. It is poor policy to wait until they are needed; and, on the other hand, it is equally bad practice to load up with an unnecessarily large supply of spare parts.

When new tools are received, they should be tested and a record made of each one to serve as a standard against which to check the particular unit after it has been repaired. All labor and parts should be charged against the tool; and a record should be kept of the purchase price of the tool, the number of hours of service, the cost of repairs, and the amount of air used together with its cost. In that way only is it possible to determine just to what extent a tool should be repaired, and when it is more economical to scrap a tool and to purchase a new one in its stead. Correct records of this kind are of the best possible guide in making further purchases. In this connection it is well not to overlook the fact that the repair department is maintained to give service to the various operating departments, and that the tool with the highest repair charges may prove to be not only the most economical one in the long run but may also accomplish the most work. A well-equipped repair department should be, first of all, under the supervision of an intelligent man. He should be a good mechanic, and should possess sound judgment coupled with "horse sense." Besides, he must be thoroughly familiar with the tools in his care so that he may know what is required to put them in proper service condition. Guessing has no place in a repair department.

For drill testing, a suitable Prony brake, scales, a revolution counter, an air-pressure regulating valve, a small receiver, and an air meter are essential—a diagrammatic arrangement of these various units, as well as of the air-pressure regulating or reducing valve, being among the accompanying illustrations. While commercial regulating valves, as far as the writer's experience goes, are not satisfactory for compressed air, the reducing valve shown has given satisfaction for many years. This valve works well when kept clean and when the chamber under the valve is filled with light oil instead of water, which has been permitted to accumulate. A small vibrator, attached to the piping, is necessary to maintain a uniform pressure, especially if the valve does not operate freely.

The type of Prony brake recommended has proved practicable and accurate throughout a long period. In constructing the brake—all the necessary details for the purpose being given—it is essential that the wheel be mounted on ball bearings and that a ball thrust bearing be provided. The top of the platform of the scales should preferably be on a level, with the center of the wheel so placed as to eliminate any chance of error. A Prony brake, made in accordance with the accompanying design, will be suitable for testing any except the very small high-speed drills.



Details of an approved Prony brake installation.

The particular brake shown has a constant of .0003, so that

B.H.P. = .0003 x R.P.M. x W

The general formula for brake horsepower is

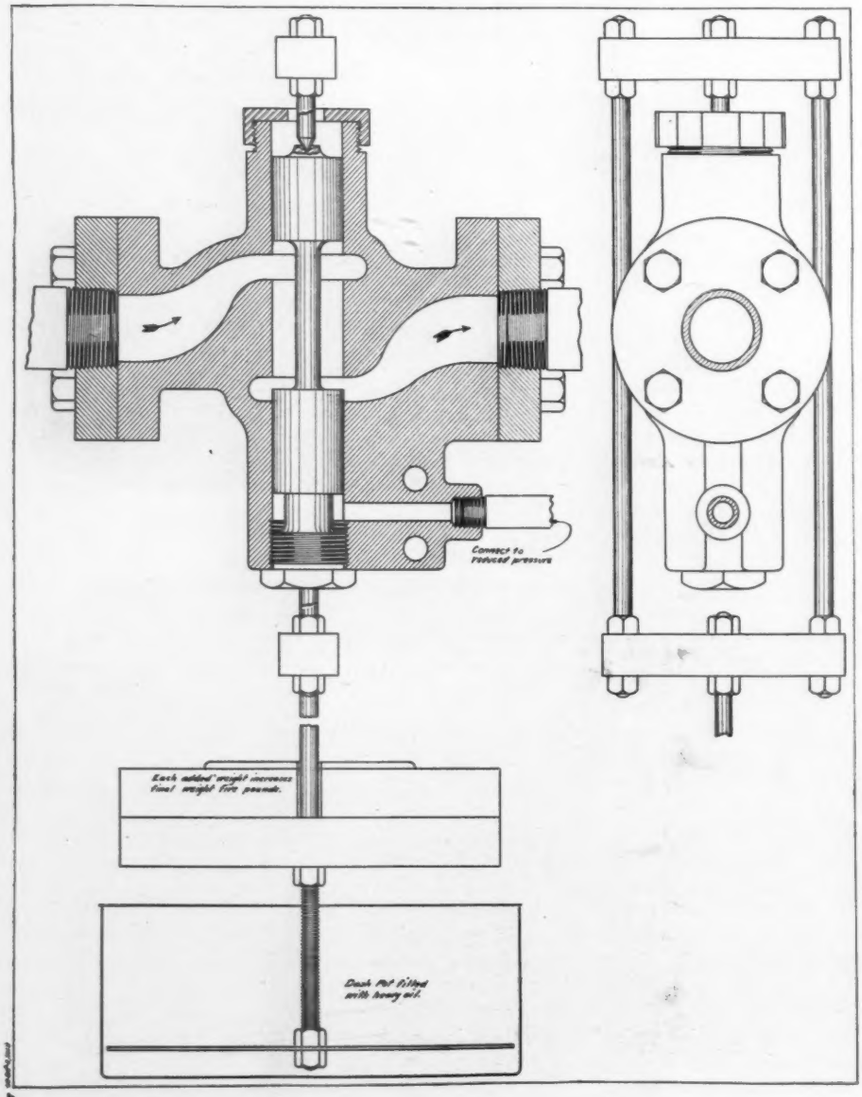
$$\text{B.H.P.} = \frac{2\pi \text{ LNW}}{33{,}000}$$

where L = Length of arm in feet (18.907 in. = 1.5756 ft.)

N = Revolutions per minute

W = Weight on scales (net weight)

$$\text{The brake constant is } \frac{2\pi \times 1.5756}{33{,}000} = .0003$$



Details of reducing valve used in connection with the Prony brake.

The length of arm was chosen to give a convenient constant for ready power computations. In employing a Prony brake the net weight on the scales must be used—that is, the scale reading minus the weight of the end of the arm resting on the scales. It is better to put sufficient auxiliary weight on the beam to just balance the weight of the end of the arm, and then the scale readings may be taken directly for W—that is, weight on scales. The scales should be of the platform type and of 300 or 400 pounds capacity with not more than half-pound graduations. A locking screw should be provided on the sliding weight if the beam is not notched. Spring scales have not been satisfactory.

Any commercial revolution counter may be used for measuring the speed, but a quick-reading counter is desirable. Ordinarily, tachometers are not satisfactory. For air-consumption readings, a meter, such as is illustrated, will be found both inexpensive and suitable if properly installed. It is necessary to have a small receiver of sufficient volume to eliminate pulsations in the flow caused by the testing of the tool, as a pulsating flow will result in false readings. This receiver should be located between the tool and the meter of the plunger type. A meter of this kind is usually calibrated at 80 pounds. For other pressures, correction factors, as indicated on the meter, must be used to secure actual air-consumption figures.

In testing riveting hammers, no practical means have so far been devised for measuring their power. The most satisfactory test that a repair man can make is to run the hammer on a hardwood block, recording the air consumption and the blows per minute, and judging the action of the hammer by the "feel." The air consumption and the speed, when compared with the test figures originally obtained, are a reliable index of the condition of the hammer. Care should be taken, however, to see to it that the same piston and rivet set are used and that the block is equally solid at all times.

The most reliable instrument for measuring the number of blows per minute is a vibrating reed tachometer. This instrument may be held against the hose line or may be suitably mounted; and readings are made directly. For riveting hammers, an instrument with a range of 800-1,700 is preferable, while a tachometer with a range of 1,500-3,700 better serves the needs of chipping hammers.

Chipping hammers may be tested just as are riveting hammers. The power of the tools can best be determined by actual chipping tests, uniformly made; and annealed boiler plate, 3/8 inch thick and properly supported, is the best material to use for the purpose. Chisels should be ground to a gage, and must be kept in good condition for satisfactory results. Experience will determine the depth of cut to take, but the larger hammers naturally require deeper cuts than the smaller ones. More nearly uniform results will be obtained if the chisel is kept lubricated during the cutting period by means of oil-saturated waste held against the cutting end.

In conclusion, it is well to know something about the extreme care and accuracy with which pneumatic tools are made. Aside from instruments of one kind or another, there is probably no class of machinery manufactured to within closer limits. Certainly there are no other tools in such general use by common labor—that frequently also repairs them—in the making of which precision is of such outstanding importance. The individual parts are usually interchangeable, as the makers must be able to supply spares. When it is realized that running clearances of one one-thousandth of an inch are common, and that even closer fits are by no means rare, then it is possible to understand why individual parts are frequently manufactured to within less than one-quarter of a thousandth of exact size.

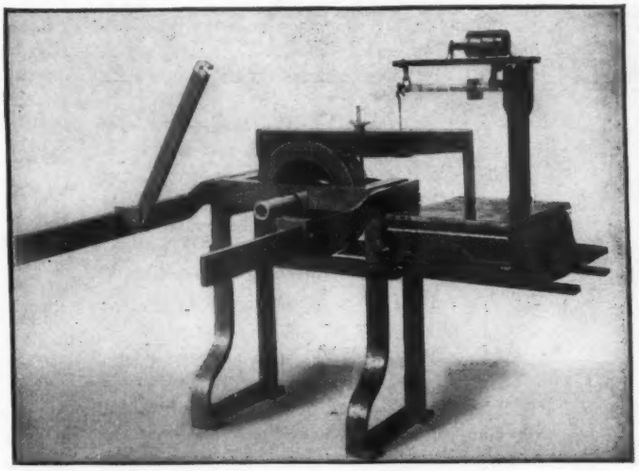
Extreme care in the selection and the treatment of materials is just as important. Experts in chemical and physical laboratories, apart from developmental and research work, have a definite function to perform in the every-day inspection of materials. Uniformity of product is maintained by testing the steels for chemical analysis and, later, after heat treatment, by testing them with special apparatus for strength or for hardness. In short, good pneumatic tools represent skillful design, painstaking heat treatment, accurate manufacture, and honest and thorough inspection.

PUTTING GOLDFISH TO WORK IN AN ICE-CREAM PLANT

AT first blush, goldfish and ice cream would seem to have nothing in common, and yet a progressive manufacturer of this toothsome foodstuff has put goldfish to work in his business. In the plant of the Whittier Ice Cream Company, of Whittier, Calif., there is a cooling tower that has caused the management no end of trouble by reason of accumulating slime and moss. All sorts of things were tried to keep the water in the tower clean, but, somehow, none proved satisfactory.

Mr. R. E. Berry, a member of the company, suddenly conceived the brilliant idea of keeping goldfish in the tower. A small pile of rock, with some spur grass, was promptly placed in the tower together with about 30 fish. By turning the cooling tower into an aquarium, so to speak, no further trouble with moss and slime has been experienced; and, instead of being a source of continual annoyance, the cooling tower is now an attraction at the plant.

A sum of $150,000 a year for 40 years has recently been voted by the Canadian government to aid in providing a bridge across the St. Lawrence River at Montreal.



A Prony brake.

PNEUMATIC SAFETY DEVICE FOR A PUNCH PRESS

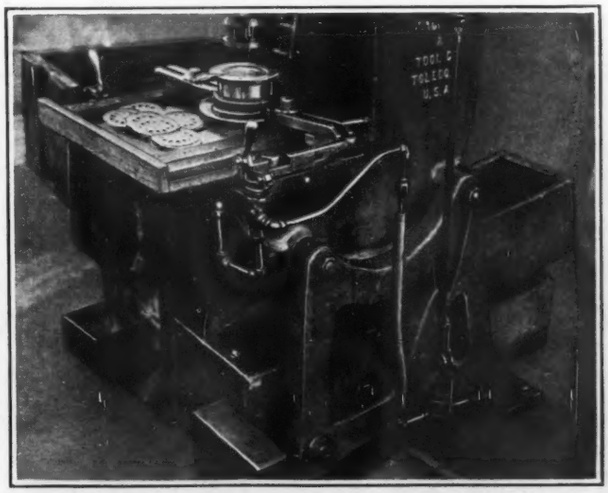
NOWADAYS, wherever machinery is in operation, the safety of those in attendance is a matter that greatly concerns the employer. Aside from the humane side of the question, it has been brought home to factory owners that accident prevention, through the installation of simple mechanical guards and kindred devices, costs far less than the time lost by employees injured because machines were not provided with safety-first features.

To be entirely effective, however, devices of this kind must not hamper the operative or interfere with production. Just what improved methods can do in the way of facilitating the working of a machine, while at the same time adequately safeguarding the attendant, is strikingly emphasized in the case of a punch press equipped with an air-driven trip instead of the usual type of guard.

As described in the *American Machinist*, the compressed-air trip in question consists of two lever-operated air valves, an air cylinder and piston, and a few pieces of pipe and fittings. The pipe, leading from the shop air line, is brought down to the left front corner of the press bed, where an air valve is located. From the outlet of this valve the air is piped across the front of the press bed to the opposite corner, where another valve is placed. From the outlet of this second valve the air goes directly to the cylinder, which is fastened to the floor at one side of the press. The pull rod from the clutch is attached to the piston of the air cylinder.

Air cannot be admitted to the cylinder to trip the press except by opening both valves at the same time. As the operator cannot do this without using both hands, he cannot possibly be injured, once the clutch is released, by the descending tools. Aside from preventing accident, the tools are free from obstructing guards at all times—an advantage that makes for increased output. The pneumatic tripping device can easily be made and attached to a press by anyone familiar with the use of pipe tools; and as most up-to-date press rooms use compressed air for one purpose or another the cost involved is a trifling one.

By running a punch press so equipped in competition with another press of the same kind but provided with a guard, it was found that the air-driven trip enabled the operator to turn out nearly 50 per cent. more work. And so that all conditions might be equal in making the test, the same man ran both machines, and the same set of tools were used on both machines to do a given kind of work.



Courtesy, American Machinist.

An air-operated trip on this punch press has added to the safety of the workman and increased the output of the machine 50 per cent.

AIR PRESSURE OPERATES DAMPER REGULATOR

IT should be of interest to engineers to learn that a damper regulator can be more satisfactorily operated with air pressure than with water pressure. It has been found that air power does not wear out the parts of the regulator every few weeks, as is the case when water is employed.

"My experience with the regulator that we are using," says Thomas Montgomery in a recent issue of the *Southern Power Journal*, "has been that the piston reversing valve soon wore out when water was being used. Since I changed to air as a means of operating the regulator, this valve has been in operation for a period of three years with the same piston. A pressure of 60 pounds is sufficient to do the work."

The output of alloy steel castings in the United States in 1925 amounted to more than 112,000 tons. This establishes a new record, and exceeds by 12 per cent. the previous record attained in 1923.

Compressed Air Magazine

—*Founded* 1896—

Devoted to the mechanical arts in general, especially to all useful applications of compressed air and to everything pneumatic.

Business and Editorial Offices:

Bowling Green Building, No. 11, Broadway, New York City. Tel. Bowling Green, 8430

Publication Office: Somerville, New Jersey

TERMS OF SUBSCRIPTION

$3 a year, U. S. A., American possessions and Mexico; all other countries $3.50 a year, postage prepaid. Single copies, 35 cents. Back issues more than six months old, 75 cents each.

WILLIAM LAWRENCE SAUNDERS
President

G. W. MORRISON
Treasurer and General Manager

ROBERT G. SKERRETT
Editor

FRANK RICHARDS
Associate Editor

M. V. McGOWAN
A. M. HOFFMANN
Assistant Editors

JOSEPH W. SHARP
Secretary

F. A. McLEAN
Canadian Correspondent

L. H. Geyer
General Manager for Europe

EDITORIALS

NEW FACTOR IN FOREIGN TRADE COMPETITION

WHATEVER may be the outcome of the creation of a European steel trust, it is undeniably certain that the successful expansion of the business of that combination will have its reflex on all markets in which the American producer of iron and steel or commodities using iron or steel are now sold. Therefore, the existing markets in which our people already have gained a substantial foothold will be the fields in which we will likeliest retain whatever advantage we enjoy because of the known character of the products that we have to offer.

Such being the case, the following item from a recent issue of *Commerce Reports* will be significant, especially as the markets of South America, so it is said, will be exploited by the European steel trust. Dr. JULIUS KLEIN—the author of the article in question, says: "To a great many of the countries of the world, our exports in 1925-26 were from two to four times as great as in 1921 to 1922. The most extraordinary gain of all is found in our sales to Venezuela, which amounted four years ago to only $7,600,000, but which had risen to $31,400,000 last year. Every important South American market shows an immense gain. Argentina has long been the biggest customer of that continent for our goods, but, although the trade was already strong in 1921-22, it had gained a further 83 per cent. by 1925-26. Exports to Columbia and Chile have nearly trebled.

"Everywhere in South America we are selling more of almost every class of manufactured goods. A remarkable illustration is furnished by automobiles. As compared with 1921-22, the value of our sales of automobiles and parts in 1925-26 showed the following increases: To Argentina, 700 per cent.; Brazil, 1,291 per cent.; Chile, 1,399 per cent.; Columbia, 1,089 per cent.; Venezuela, 540 per cent.; and in the minor countries there were similar gains.

"Among the many other articles which we are sending to South American countries in rapidly growing volume may be mentioned moving-picture films, textiles, iron, and steel (especially construction material.) The long-time growth in our sales there of industrial and agricultural machinery continues steadily."

GOVERNMENT COMPLETING OIL-SHALE PLANT

THE Government oil-shale experimental plant near Rulison, Colo., will soon be ready for carrying on work that will probably have an important bearing on the development of our future fuel-oil supplies.

Under the auspices of the United States Bureau of Mines, the plant in question is being equipped with two essentially different types of retorts to be used in the extraction of oil from domestic shales. The purpose of this procedure is to determine which of the types will answer best in dealing with American oil shales. The subject is a rather complex one, and involves, among other problems, the determination of the quality and the quantity of the products that can be obtained to advantage by the two systems of extraction and which of the processes will be superior from a commercial standpoint.

According to our contemporary, the *Oil Bulletin:* "Laboratory experimental work of the Bureau of Mines, extending over a period of six years, has indicated two entirely different methods of producing refinable oils from oil shales. Both methods are fundamentally sound, as far as can be determined by laboratory investigation. In the first method, the shale is heated slowly and enough scavenging steam or gas passed through the distilling mass to prevent undue decomposition of the oil. This method results in a relatively low yield of crude oil of relatively high quality, and a relatively low yield of fixed gas of relatively high heating value. The crude oil so obtained can be sent to the refinery stills without further treatment.

"In the second method the shale is heated rapidly, care being taken not to reach temperatures high enough to decompose the oil products, and a large excess of scavenging gas is passed through the distilling mass to remove distillation products as rapidly as they are formed. This method yields a maximum quantity of crude oil of relatively poor quality and a maximum volume of fixed gases of relatively low heating value. The crude oil so produced requires a preliminary coking distillation before going to the fractionating stills, but either method, properly operated, apparently will produce the same results in finished oil products."

Increasing public interest in the maintenance of our oil supply will add to the importance of the work that is to be brought to a climax by the Bureau of Mines in the Colorado plant. There are in our oil-shale deposits potential billions of barrels of oil; and it is of vital economic value to determine as soon as possible how these shales can be utilized on a commercial scale when the time for their utilization arrives.

INLAND WATERWAYS SERVICE SHOWS PROFIT

MANY of our readers are aware that the Government, as a war measure, called into being a barge service to operate jointly on the Mississippi and the Warrior rivers. To this end, specially designed shallow-draft steamers and a fleet of barges were built for operation in the waters mentioned.

The period of conflict was passed before the vessels of the fleet were in commission; and there were those among the nation's critics that freely proclaimed the economic failure of the undertaking. The public was told that there was little if any chance of adding profitably to the craft already engaged on the Mississippi River in the hauling of bulk freight; and the same skeptics could not see how service on the Warrior River would be of benefit or pay for the venture. The project had for its ultimate purpose the stimulating of long hauls on our inland waters; and it was admitted by those in favor of this governmental scheme that it would pay for itself eventually even though the returns might fail to justify the outlays in the beginning. The plan was really to provide an object lesson that would have its reflex finally upon private enterprise and stimulate the wider utilization of our land-locked waters for transportation.

Such being the background of the Mississippi-Warrior Barge Service, it is of timely interest to refer to the report recently made to the Secretary of War by Brigadier-General ASHBURN, executive of the Inland Waterways Corporation. General ASHBURN states that the service in question will show a net profit of $347,632 for 1926.

The record in the case of the Mississippi-Warrior Barge Service is of suggestive value in view of Secretary HOOVER'S recent pronouncement regarding the aid that our farmers may obtain by a better or a fuller use of water transportation. As he expressed it: "If we could secure the lowered transportation charges promised from waterways and thereby restore an additional six to twelve cents per bushel on grain, we would add a very important percentage to the farmer's profit. It is generally agreed that the price of our farm products is determined at those points on our seaboard or abroad where the competitive streams of exports come together. Thus, the price at the farm is the price made at this junction market, less the cost of transportation and handling to this market." Anything that would tend to lower the cost of transportation up to the junction market would give the shipper that much advantage in competition with his foreign rivals.

Indeed, the farmer would not be the only one to reap a benefit by a lowered cost of carriage. Every department of American industry would be the gainer should cheaper freight rates be obtainable for the moving of com-

modities anywhere within our land; and it is to be hoped that the example set by the successful operation of the Mississippi-Warrior Barge Service will induce capital to look more kindly upon this field of transportation and come to believe it deserving of encouragement.

STRENGTHENING OUR TIES WITH CANADA

MILLIONS of people in Canada and in the United States are unaware of the accumulating fiscal ties that are strengthening the relations, the mutual interests of the two neighboring and neighborly countries.

Some interesting facts regarding this situation were brought out a few weeks ago by WILLIAM PHILLIPS, Manager of the Industrial Department of the Canadian National Railways, while visiting New York City. We quote some of the outstanding points mentioned in an article that appeared in *The New York Times*. According to Mr. PHILLIPS: "There has been a remarkable impetus to industrial development in Canada during the year, and a survey made by representatives of the Canadian National indicates that there is every promise that this industrial growth will continue upon an even larger scale during 1927.

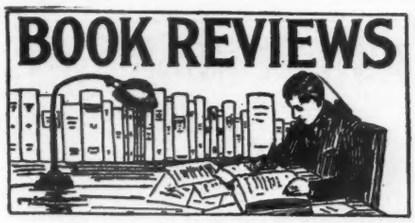
"Power is becoming a more and more important factor in industrial development, and Canada, by its fortunate situation in regard to water power, has a peculiarly advantageous position. The available power in Canada was increased by 719,000 H.P. during 1925, bringing the total installation in the Dominion to 4,290,000 H.P. This cheap and easily available power is serving to attract a flood of American capital to Canada for industrial enterprise."

Manifestly, this influx of American capital is for the common good of all concerned. In many cases, the capital represents the creation not only of vast power plants but the building of factories of different sorts to utilize the low-priced energy thus placed at the disposal of the manufacturer. One of the plants in question has been called into being on the Saguenay River, where ultimately an industrial city of 50,000 inhabitants will arise. The huge plant in question will involve eventually an investment totaling more than $80,000,000.

Examples of this sort of collaboration are the best evidence of cordial international relations; and this trend deserves every encouragement because of what it contributes towards lasting peace and prosperity.

A new highway is to be built from Liverpool to Manchester, England—a distance of from 30 to 40 miles. After some delay, the Ministry of Transport has approved the project, which will involve an outlay of about £3,000,000. The British government will take care of 75 per cent. of the total cost.

The 1927 Convention and the Good Roads Show of the American Road Builders' Association are to be held in Chicago, Ill., during the week of January 10th.



THE ELEMENTS OF DYNAMIC SYMMETRY, by Jay Hambridge. An illustrated volume of 140 pages published by Brentano's, New York City. Price, $4.00.

DYNAMIC symmetry, for the sake of those unfamiliar with the term, is a law of proportion discovered by the author in plant and shell growth and found subsequently by him to have been used by the ancient Egyptians and Greeks in their works of art. Broadly stated, the principles involved can be employed to advantage in all phases of art—art embracing as well the designing of pretty nearly any product that, in the final analysis, may be made more effective or more appealing to the purchaser, or more suitable for the purpose to which it is put, by so modeling it that the thing will be pleasing to the eye.

The author has developed his subject in a simple and attractive way, and there should be many persons in different branches of industry that may profit by the ownership or the reading of this work.

HOW INSECTS LIVE, by Walter Housley Wellhouse, Associate Professor in Entomology, Iowa State College. An illustrated volume of 435 pages published by The MacMillan Company, New York City. Price, $5.00.

INSECTS may be broadly classed as injurious or beneficial according to the way in which they affect man either directly or indirectly. The subject of insect control—be the object that of propagation or eradication—depends fundamentally upon a knowledge of how various insects live, multiply, and thrive. When one seriously sets out to acquire this knowledge, the life histories of a vast number of these small or even minute creatures reveal stories of a truly fascinating nature. Some of these insects have curiously interesting and even complex social organizations that constitute worth-while examples to humankind; and their behavior among themselves is something likely to produce wonderment in the mind of a sympathetic investigator.

Professor Wellhouse has produced a book that is absorbing and extremely well done; and we strongly commend it to those of our readers that are interested in the ways of the lesser orders of life that are found on every hand.

DIESEL ENGINES: MARINE, LOCOMOTIVE, STATIONARY, by David Louis Jones, Chief Machinist, United States Navy. A copiously illustrated book of 565 pages published by The Norman W. Henley Publishing Company, New York City. Price, $5.00.

NONE of our readers has to be told that Diesel engines, or engines operating upon the principles first utilized by Doctor Diesel in internal-combustion engines, are bringing about revolutionary changes wherever prime movers are used for one purpose or another. The Diesel engine as a stationary unit, or as a mobile source of power either ashore or afloat, is gaining rapidly in its applications, and therefore a knowledge of this type of engine is of growing importance in all departments of our industrial or engineering life. The author is a practical man and his aim has been to provide a complete and practical treatise that may be of value to thousands of his fellows whose problem it is to erect, to install, and to operate engines of this character.

In the preparation of his volume, Chief Machinist Jones has purposely made less of the theoretical side of his subject and more of that phase of the subject that would be of help to the man actually engaged in operating a Diesel engine and having to do with the upkeep of such a machine. We believe this book will prove a valuable addition to those works already written upon the Diesel engine, and will be of the greatest assistance to the man for which it was especially written.

THE SAGA OF A SUPERCARGO, by Fullerton Waldo. An illustrated volume of 309 pages published by Macrae-Smith Company, Philadelphia. Price, $3.00.

THIS entertaining book is the outcome of a voyage made by the author to Greenland not long ago aboard a Norwegian steamship in the capacity of supercargo.

To most of us, Greenland is so remote that we know of it mainly because it figured on the maps of our schoolday geographies. But Greenland has other ways of reaching our understanding by occasional reminders of a grimmer character. It is Greenland's ice cap—the survival of a glacial period that once cloaked sunnier parts of the world—that gives birth to the icebergs that float far southward to menace shipping bound to and fro across the Atlantic. Greenland concerns us, however, even more directly, because she furnishes the world with much of the kryolith used in the production of aluminum, in the manufacture of porcelain and enamel, and in the production of certain sorts of opalescent glass. Mr. Waldo has told in a lively way much about Greenland and the Greenlanders that is unfamiliar to many of us. The book is entertaining from start to finish, and informative as well.

TWENTIETH CENTURY ADVERTISING, by George French. An illustrated work of 588 pages published by D. Van Nostrand Company, New York City. Price, $6.00.

DESPITE the much that has been written and published latterly regarding the preparation and the purposes of advertising copy, there is still warrant for the volume that has recently been written by George French. The author has approached his topic from the less developed angle—that is to say, he has confined his labors to telling the story of twentieth century advertising in the form of a historical resumé of its development during the last 25 years.

Mr. French has been able to deal with his subject from a fresh or disinterested point of view. This is because he has not had directly to do with the routine of an advertising agency or with those responsibilities that belong to an advertising manager. On the other hand, the author has, as he expresses it: "Assisted business concerns and institutions to solve their

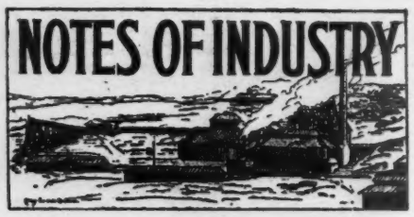
publicity problems, and have been asked to sit in when questions arising from difficult advertising problems were discussed and decided. I have been close to the vital, the inmost, problems of advertising; but not in a way that has throttled my judgment or made me consider the expediency of limiting my views." This background of experience has made Mr. French admirably fitted to prepare a book that is essentially a historical treatment of a field of endeavor that is daily becoming more important.

FREIGHT-TRAIN RADIO SUCCESSFUL

THE swinging lantern and the waving hand have served for signaling purposes for many years between the more or less widely separated ends of a freight train. These means of communication have answered well so long as visibility was satisfactory; but many a railroadman can recall how smoke, mist, and falling snow have impaired visibility and made for mistakes. Now comes the radio telephone to insure a new and more certain means of intercommunication between the locomotive and the trailing caboose of a freight train. The New York Central Railroad is testing a 2-way radio-telephone system for freight service; and the results so far are extremely promising.

According to a report issued by the New York Central Lines, "Tests made on the Western Division have demonstrated clearly that successful radio-telephone service can be maintained between a conductor or brakeman in the caboose and the engineman or fireman on the engine of a freight train 100 or more cars in length. The results were satisfactory even though the train moved through a severe electrical rain storm; communication was unimpaired when rounding curves or when crossing steel bridges; and passing trains did not interrupt audible communication. In one case, a special test was made to ascertain whether the new system would be effective in the event the train broke in two—as sometimes happens with long freights. The locomotive was detached and sent ahead a distance of 4 miles, and yet radio conversation was kept up despite this gap. Equally good results were obtained when the engine was stopped and while it was backing up to be recoupled to the train."

The radio equipment placed on both the engine and the caboose consisted of special receiving-transmitting sets, with the necessary motor generator, batteries, and loud-speaking receiver. An antennae, consisting of 32 feet of ½-inch brass pipe—supported on special brackets placed 12 inches above the cab roof—was installed on the engine. The antennae on the caboose was composed of 32 feet of rubber-insulated wire mounted on supports. The special transmitting-receiving sets contained 7 tubes: 3 for transmitting and 4 for receiving. The transmitting tubes consist of a 50-watt oscillator, a 50-watt modulator, and 7½ watts for speech amplification. A wave length of 115 meters was employed.



If a process for the extraction of oil from coal, invented by Dr. Paul Dvorkovitz, a Russian, proves as successful as he claims it to be, declares the *Westminster Gazette*, Great Britain will never have cause to fear a shortage of petrol. By his method of extraction, so it is said, 500 tons of coal will yield 2,000 gallons of motor spirits, 6,500 gallons of lamp oil, 3,000 gallons of lubricating oil, and varying amounts of paraffin, phenol, pitch, sulphate of ammonia, and sulphur. And after all these substances have been separated from the coal, asserts the inventor, there will be a residue of 374 tons of smokeless fuel, which will give greater heat than the original coal, itself.

According to a recent report of the American Research Foundation, sufficient gasoline is now being reclaimed from natural gas to keep 2,000,000 motor cars in operation. As this by-product of natural gas was formerly wasted, it may surprise many of us to learn that our natural-gas-gasoline output now exceeds 3,650,000 gallons a day—representing approximately 10 per cent. of the total motor fuel production of the United States. These figures bring home to us what well-directed conservation or utilization of by-products can be counted upon to do.

According to an estimate made by the Department of Agriculture, the United States will soon have 500,000 miles of surfaced roads. Last year, 31,541 miles were surfaced, a record that 1926 bids fair to duplicate.

There has recently been developed in Germany a process for the manufacture of sulphuric acid from gypsum. While it has been known for some time that gypsum is suitable for this purpose, yet the production of sulphuric acid from this material has heretofore not been commercially practicable.

It has recently been reported that in one year the Panama Canal tolls on 56,000,000 barrels of crude oil and refined petroleum products, moved eastward during that period, amounted to $7,000,000—almost enough money to pay for the maintenance of that great waterway.

At 212 degrees atmospheric pressure, one pound of coal will evaporate 10 pounds of water while one pound of oil will evaporate 16 pounds of water.

Minerals produced in the United States in 1925 had a total value of $5,696,000,000, or 7 per cent. more than the 1924 output.

Of a total population of 250,000 in the City of Bagdad, but 1,600 use electricity.

The world's mill consumption of cotton of all growths for the year ending July 31, 1926, reached the very high figure of 24,681,000 bales, an increase of about 1,390,000 bales over the amount used in the fiscal year preceding.

Stories are coming to our notice of lightning striking and damaging concrete highways. Apparently, the danger lies in the metallic reinforcing used. A typical case of this kind is described by W. E. Wheat in a short paper before the American Society of Civil Engineers. From the point first struck, the current jumped in both directions for a distance of about 700 feet—leaping from one reinforcing rod to other rods.

A total of $2,178,325,000 has so far been appropriated this year on engineering undertakings of one kind or another awarded in the United States. Of this sum, $1,325,665,000 is being spent on private operations and $852,660,000 on public construction jobs, including roadbuilding.

The extent to which the mining industry has been developed in the Belgian Kongo is not generally realized. Take, for instance, the Province of Katanga where most of the Kongo's mineral wealth has been exploited on a commercial scale. According to the United States Department of Commerce, Kantanga claims first place among the cobalt- and radium-producing countries; third place as regards copper and diamonds; and the prospects are that before long it will be an important producer of tin and gold. In 1925 the ore raised exceeded 2,000,000 tons.

More than 2,000,000 pounds of copper were required by the United States Treasury Department in 1925 to mint $5,115,675 worth of pennies and nickels. The last-named coin, paradoxically, contains 75 per cent. copper.

According to a survey recently made, there are in the world today 900 broadcasting stations which serve anywhere from 12,000,000 to 15,000,000 radio sets. Of these, 500 stations are operating in the United States where about half of all the radio sets, or 5,500,000, are in use.

The Swiss railroad system, consisting of 1,828 miles of trackage, is gradually being electrified. At the beginning of 1925, about 31 per cent., or 590 miles, had been changed from steam to electric haulage—representing an increase within a year of 177 miles.

The gold mines of the Transvaal crushed 500,000 tons more ore during the first half of 1926 than in the corresponding period last year, with a resulting increase in total production of 105,000 ounces of gold.